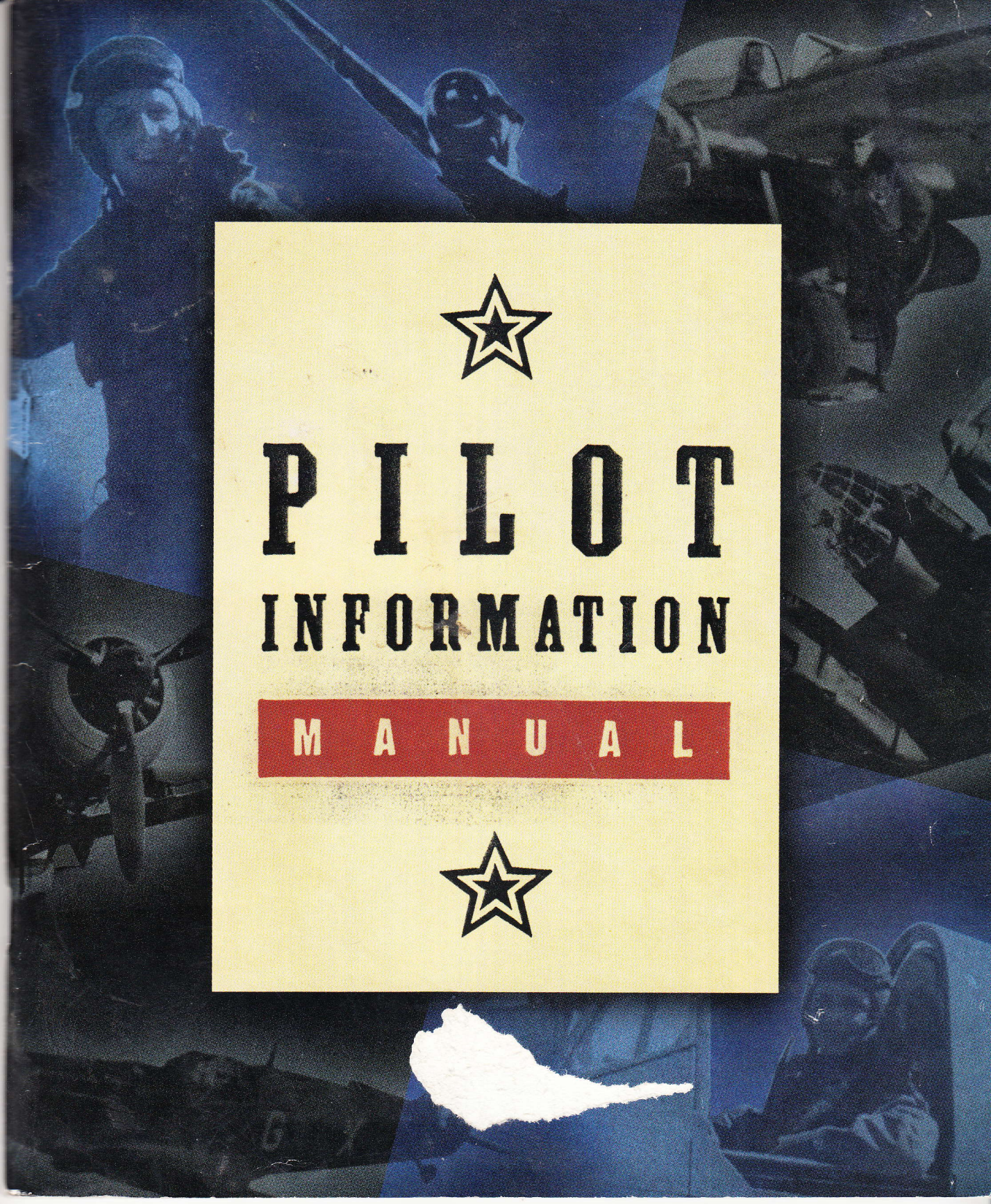

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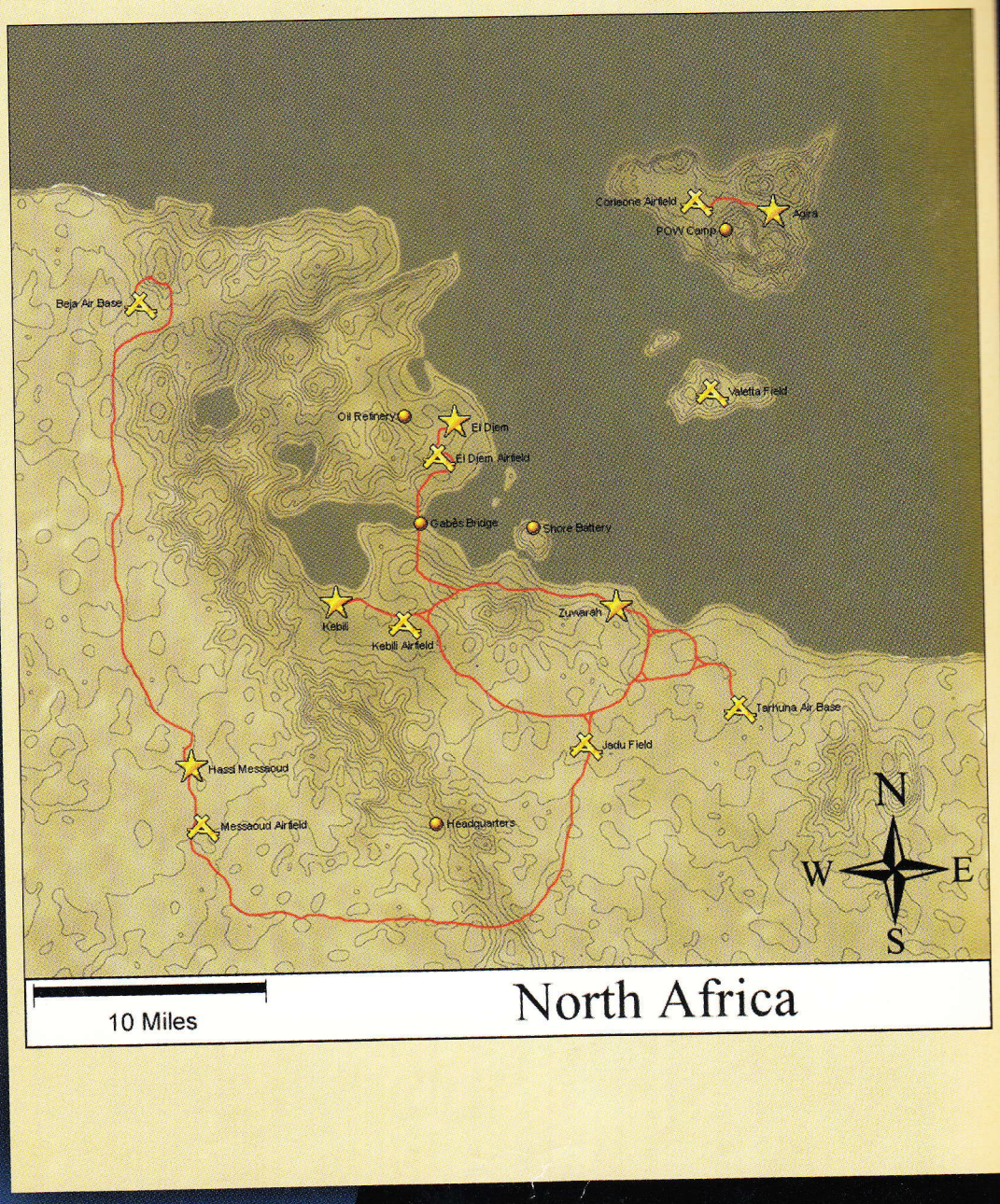

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PREFACE

The roar from the massive engine pulsates through your aircraft. Moisture on your leather-gloved hand spreads across your palm as you push forward on the stick. As the aircraft's nose drops, a shimmer of sunlight reflects on metal: your prey. You dip your wing and start a dive to meet the enemy head-on. Your squadron follows your break and descends with you into the approaching bomber stream. The battle begins.

The descent doesn't go unnoticed. Gun turrets in the bombers start turning toward you. You are now closing on the wave of bombers coming straight at your aircraft. You squint through your gunsight, taking aim at the lead bomber as orange tracers scream past your plane. You are in range. A bomber is lined up in the gunsight. You ease the grip on the stick in anticipation. Radio chatter crackles in your ears as you pull the trigger to fire. The roaring of the engine and guns merge together as you and your squadron lunge beneath the bomber stream. A muffled explosion jerks your head around. A bright orange fireball signals destruction as a bomber falls slowly from the sky. As the bombers break formation, you pull back on the stick to come back around for another pass. Time to move in for the kill. Sounds of explosions, engines, and guns fill your cockpit. The battle rages—welcome to Fighter Squadron.

Fighter Squadron is a squadron based game. In this game, ten aircraft fly for Britain, Germany, and the United States. Missions are set in locations of North Africa, Dover, and Germany. Here the various squadrons perform different roles in a multitude of missions. From bombing and ground attack to combat air patrols, there is a multitude of assignments waiting for you.

CONTENTS

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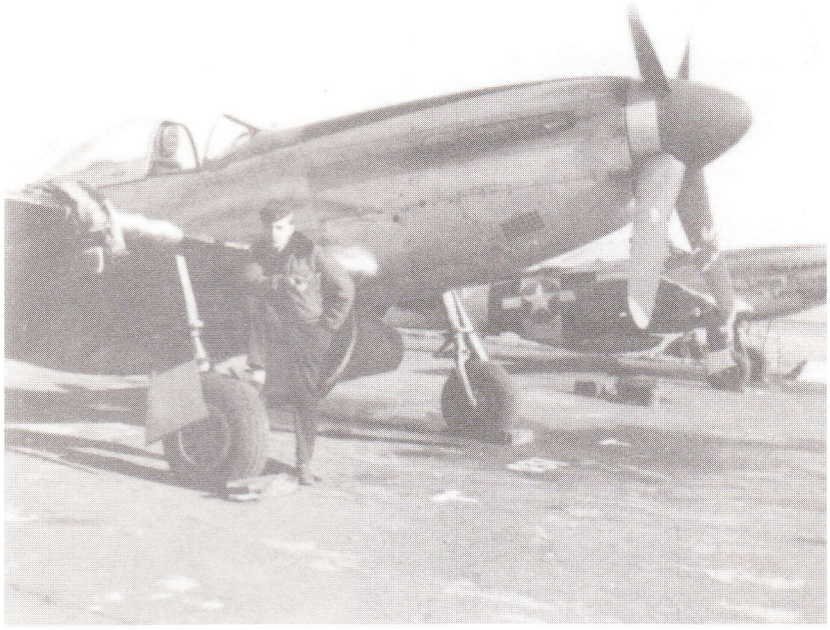
INSTALLATION

HOW TO INSTALL

1. Before installing, close all other applications.
2. Insert the **Fighter Squadron CD** into your CD-ROM drive and wait a few moments until the Fighter Squadron title screen appears. If the title screen does not appear, run **Setup.exe** from the CD.
3. There are several buttons on the title screen. Click the **Install** button to begin the installation process and then follow the on-screen instructions.

If you install the new DirectX 6.0, you will need to restart your computer for the new drivers to take effect.

Now you can run *Fighter Squadron* by selecting **Fighter Squadron** from the **Start** menu or by clicking **Play** on the CD title screen.



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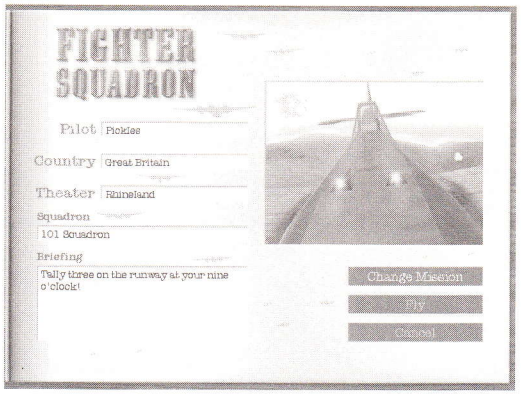
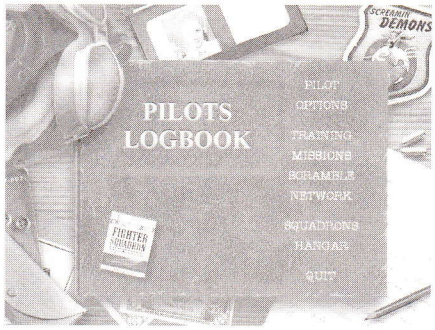


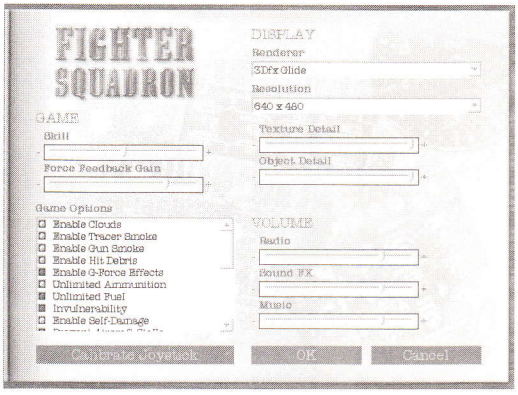
Scramble is the fastest way to fly and fight in *Fighter Squadron*. When you select Scramble from the main screen, you will be randomly placed in a squadron in one of several missions. Before you get airborne in Scramble, set your Options. This will ensure that you have the best possible gameplay experience. If you are new to flight sims, first go to the Training area where you can become familiar with the basics of flying aircraft. If you would like to fly in an enemy-free world to get acquainted with the particular characteristics of each aircraft, select **Hangar** from the Main menu. Note: To exit a Scramble Mission, press the **Esc** button.

PRE-FLIGHT CHECKLIST



1. From the Main menu select **Options**:
2. Set up the remainder of your preferences for playing the game:

Skill	Easiest to Hardest
Force Feedback Gain	Less/More
Calibrate Joystick	Click this to start calibration procedures
Volume	Radio Sound FX Music
Display	Renderer Software 3DFX Direct3D
Game Options	Enable Force Feedback Enable Red-out/ Black-out G Effects Unlimited Ammunition Unlimited Fuel Invulnerability



3. Aircraft Controls
   All keyboard commands for flight controls, radio commands, and weapons are listed in a text file that can be opened and edited by any text editor (such as NotePad). This gives you the option to set the keyboard, mouse, and joystick commands to your preference. The text file is called **keyboard.inp** and is located in the main folder that was written to your hard drive during installation. After setting your general preferences, select **Scramble** from the **Main** menu. Selecting Scramble places you into a random mission in flight. (To lean more on how to use the keyboard.inp file, read the ReadMe.txt included on the Fighter Squadron CD.)

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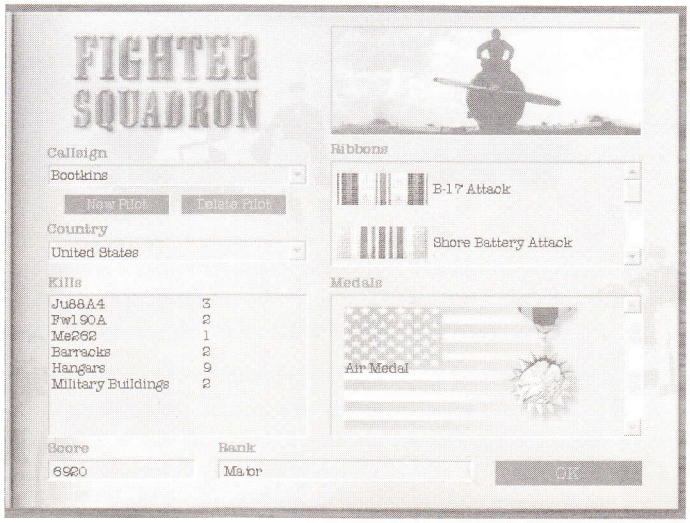
PILOT

To create a new pilot, click on **New Pilot**, then name the pilot, and then select a country.

In Fighter Squadron, the numerical scores are player-based while the win/lose record is based upon the mission. Since you have the ability to move to other aircraft within the squadron when you are shot down, this keeps the scoring logical.

- **Call Sign** Your combat name goes here.
- **Country** Your choices are Britain, Germany, and the United States.
- **Kills** Aircraft types shot down and structures destroyed by your squadron. Aircraft are listed by the greatest number shot down.
- **Ribbons** These are awarded to you when you successfully complete your mission.
- **Medals** Medals and honors awarded to you during your flying career. As you accumulate larger scores, you are rewarded accordingly.
- **Score** Your total score is determined by accumulating points associated with air kills and structures destroyed. Points are subtracted for aircraft lost in action.
- **Rank** The total score is used in conjunction with ribbons and medals awarded to the pilot to determine your rank. Rank is important since it determines how much control you have over your squadron. Everyone starts out as a 2nd Lieutenant – U.S.; Pilot Officer – Britain; Leutnant – Germany.



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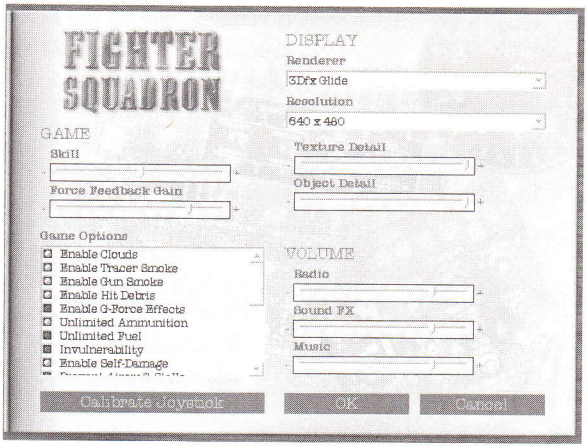

This is the area where you can set the different functions for various aspects of the game.

- **Skill** — Easy/Hard
- **Force Feedback Gain** — Less/More
- **Calibrate Joystick** — Click this to start joystick calibration.
- **Volume** — Radio – Sets the volume of the radio broadcasts available in the game.
  Sound FX – Sets the volume level for the sound effects in the game.
  Music – Sets the volume level for the music in the game.
- **Display** — Renderer – Selects what method will be used to render the game: Software; 3DFX; Direct3D

  If you have a 3Dfx based 3D video card, then the 3Dfx Glide renderer should provide you with the best performance and visual quality. If you have a 3D accelerator based upon another manufacturers chipset (i.e. nVidia, Matrox, ATI, S3, etc.) you should select the Direct3D renderer. The software renderer may be used in the absence of a 3D graphics accelerator and can provide reasonable visual quality and frame rates at reduced resolutions. However, a good 3D graphics card is highly recommended for playing Fighter Squadron for optimum performance and graphic quality.

  Note: Fighter Squardron uses DirectX 6 however, some 3D cards will report DirectX 5 drivers in the Renderer list. These drivers should perform fine with Fighter Squadron and DirectX 6. If you experience any visual anomalies, contact your video card manufacturer for updated drivers.
- **Resolution** — Sets the screen resolution for the game.
  In general, if you choose a lower resolution you should see an increase in frame rate while playing the game. This is especially true for the Software renderer; however, higher performance 3D accelerators may be fast enough that there is little noticeable frame rate difference between resolutions.
- **Texture** — Detail – Sets the level of detail used for textures.
  In most cases, Texture Detail can be set to maximum for the Software renderer without significantly degrading the frame rate. The Texture Detail control will have the greatest impact when using the 3Dfx Glide or Direct3D renderers.

  If you are using a 3D card with less than 8MB of texture memory, you may experience pauses as new objects (hence, new textures) come into view. This is most noticeable when circling above an airfield or town. Lowering the Texture Detail level will decrease the amount of texture memory required on the 3D card. As a quick test, you can set the Texture Detail to the minimum setting and fly a mission to test for pausing. If you don't notice any pauses, begin to increase the Texture Detail until you find a good compromise between visual quality and consistent frame rate.

- **Object Detail**

  If you are running the Software Renderer, or have attempted to increase the frame rate by minimizing the Texture Detail, the Object Detail control should be adjusted next. Lowering the Object Detail level should improve frame rates for the Software Renderer and for all but the higher performance 3D accelerators. Some tuning of this control may be required to find the best compromise between visual quality and frame rate.

- **Game Options**

  - Enable clouds.
  - Enable trace smoke.
  - Enable gun smoke.
  - Enable hit debris.
  - Enable Red-out/Black-out Force Effects –If enabled you will experience the effects of pulling too many 'G's through a turn or dive that could cause you to black out. Black-outs occur when subjected to positive 'G's; Red-outs occur when subjected to to negative 'G's.
  - Unlimited Ammunition – If enabled, you will never run out of ammo.
  - Unlimited Fuel – If enabled, you will never run out of fuel.
  - Invulnerability – If enabled, you can't be killed.
  - Enable Self-Damage – Allow gunners to shoot your own plane
  - Prevent Aircraft Stalls – Limits elevator control inputs to prevent the player from pitching up violently, causing his aircraft to stall instantly.
  - Enable Engine Torque Effects – Apply engine torque to airplane. This makes takeoff's more difficult.
  - Couple Steering to Rudder – Couples the tail or nose wheel steering to the Rudder control input
  - Couple Rudder to Aileron Controls – Couples the rudder to the aileron control inputs. This option should generally be enabled if you do not have rudder pedals. **Note**: If both Couple Steering to Rudder and Couple Rudder to Aileron Controls are selected at the same time, the Couple Rudder to Aileron Controls will override the other.
  - Enable Takeoff Wind – Enables wind effects below 50 feet above the ground. Disabling this option can make takeoffs and landings a bit easier.
  - Show enemy aircraft on map – Displays the current positions of enemy aircraft (in red) on the in-game map.
  - Padlock Distant Targets – Allow padlocking of targets that are farther than 6 miles away.
  - Take Control of Any Airplane – Allow taking control of airplanes in other squadrons.
  - Enable Force Feedback – Checkbox to enable/disable Force Feedback.
  - Full Screen Intro Movie – If enabled, the intro movie will fill the entire screen, otherwise, it is displayed in a reduced size window.
  - Enable Intro Movie – If enabled, the intro movie will play each time you run Fighter Squadron.
  - Play CD Music – Enable CD music playing while in Sim.
  - Reverse speakers
  - Conserve hard drive space – After Fighter Squadron is installed and you have selected a renderer, the game must customize textures for the selected renderer. These customized textures are stored on your hard drive in a texture cache file which can grow to over 200 MB as you play missions in each theater. If the "Conserve Hard Drive Space" option is enabled, the texture cache file size will be limited to approximately 80 MB. The downside of enabling this option is that whenever you change a theatre, the load time will be longer due to the building of the texture cache for that theatre. Note: Changing renderers will also require the texture cache to be rebuilt.

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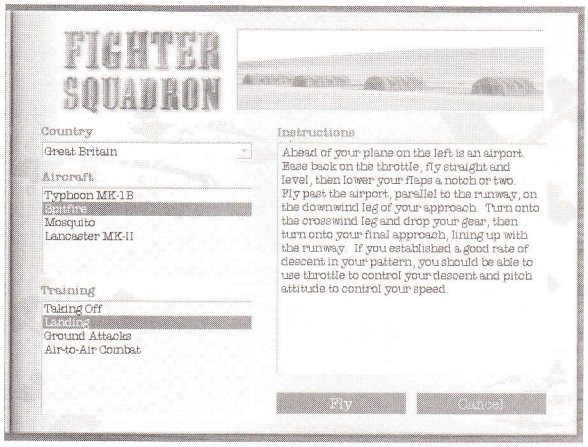
TRAINING

A successful combat pilot requires a thorough knowledge of the aerodynamic principles and physical forces that act upon an airplane. In combat, this knowledge is critical to completing combat missions successfully. If you are new to flight sims and want to learn how to fly, read this chapter and then proceed to the training section of the game.



Training is offered to help you get familiar with each aircraft through a series of training exercises. You should proceed through takeoff, landing, and then move on to combat maneuvers. As you complete each training mission, hit the **Esc** key to end the mission and move on to the next. Note however, it is not required that you complete your training before entering the single player missions.

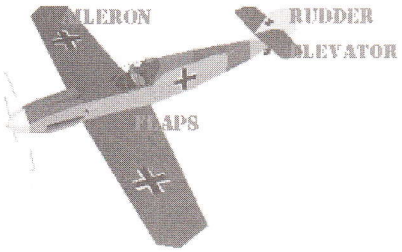
Section One of Training gives you a basic overview of aircraft control systems that are functional in Fighter Squadron. Section Two deals with the basic physics of flight. Section Three outlines the principles of flying. Section Four is step-by-step instruction on take-offs, climbs, descents, and landings. Section Five is an overview on air combat tactics. Section Six provides a set of instructional maneuvers to help you get acquainted with the flight characteristics of the various planes in Fighter Squadron. Section Seven shows you how to perform several standard air combat maneuvers.

SECTION ONE: AIRCRAFT BASICS

The following are the aircraft control systems. Each primary system results in movement in one direction. Used in combination, they enable you to perform complex maneuvers.

Aircraft Control Systems

Ailerons move in opposite direction—when one aileron goes up, the other goes down. Movement of these surfaces causes the plane to roll left or right



CONTROL SURFACES

Flaps always move in the same direction. Flaps increase the amount of wing area and are useful in both landing and take-off situations.

The **rudder** is used to move the airplane's tail left or right (yaw). To make a turn, you use a combination of the rudder and ailerons together.

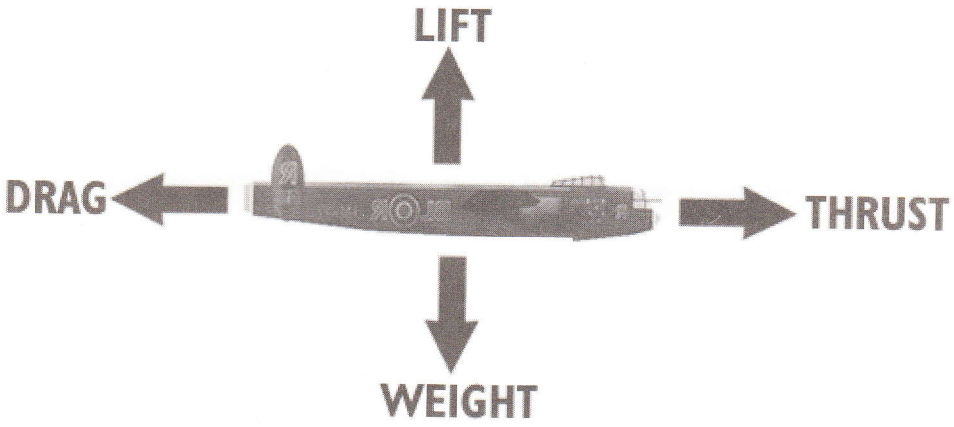
The **elevator** is attached to the back of the horizontal stabilizer. You use it to move the nose up or down (pitch) during flight.

SECTION TWO: THE PHYSICS OF FLIGHT

Fighter Squadron: The Screamin' Demons Over Europe is a flight simulator that realistically approximates the physical properties of flight. To master the complexities of flight will require a basic knowledge of how physical properties effect your motion in the air. Understanding the physics of flight greatly improves your chances of staying alive.

The Four Forces of Flight

Lift is the upward force that acts on your aircraft. It is the key aerodynamic force opposing weight. Lift is created by the effect of wind passing over and under the wing. During flight, there are pressure differences between the top and bottom wing surfaces. This is due primarily to the shape of the wing. This is why various wing shapes have an effect on the aircraft's performance.



The **weight** of an aircraft is not constant. Aircraft weight changes based on equipment installed, personnel on board, fuel, and ordnance load. During a flight, the weight decreases due to fuel consumption and ordnance used.

Thrust is the forward-acting force that opposes drag and propels your airplane forward. Propeller-driven aircraft produce thrust by accelerating a large mass of air through a small velocity change. During straight-and-level unaccelerated flight, the forces of thrust and drag are equal. To increase thrust, you must increase power using the throttle. The increased power causes thrust to exceed drag, therefore increasing airspeed. You will accelerate only as long as your thrust exceeds the force of drag.

Drag is associated with lift. Drag is caused by any aircraft surface that interferes with the smooth airflow around the airplane. When you increase airspeed, you increase drag. Drag acts against the direction of flight, opposes the forward-acting force of thrust, and limits the forward speed of the airplane. So remember to put your landing gear up after you take off!

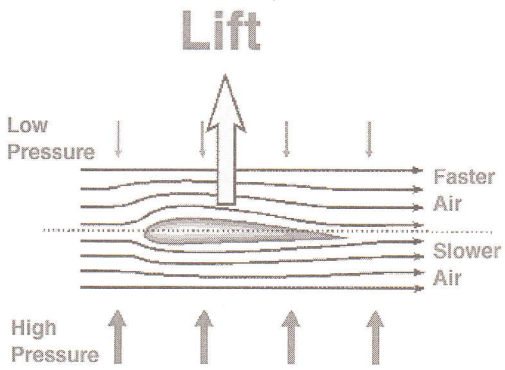
Bernoulli's Principle

Discovered by the Swiss physicist, Daniel Bernoulli, Bernoulli's Principle was the basic principle of pressure differential of subsonic airflow. This principle says, "as the velocity of a fluid (air) increases, its internal pressure decreases." Air acts just like a fluid as it flows around a wing. Air separates at the point of impact on the leading edge of the wing and flows both over and under the exterior surface.

The top of a wing is curved and thus longer than the bottom. As the aircraft moves through the air, the air moves over both surfaces. Since the air moving over the top surface must travel a greater distance, the pressure is less on top of the wing than on bottom. The high pressure area under the wing creates lift. At faster speeds, the pressure differential is greater and more lift is available.

Newton's Third Law of Physics

The remaining lift is provided by the wing's lower surface as air striking it is deflected downward. Newton's Third Law of Motion states, "for every action there is an equal and opposite reaction." The air that is deflected downward produces an upward, lifting action. However, most of the lift comes from the decreased pressure above the wing.



Wing Cross Section and Air Flow

Airfoil Terminology

The airfoil or wing is the part of the aircraft acted upon by aerodynamic forces. This interaction produces lift from the interaction. The following are terms used to describe it:

- **Leading Edge** – the part of the wing that first meets the airflow
- **Trailing Edge** – the part of the wing where the airflows rejoin

Angle of Attack

Wings are made angled slightly upward with the leading edge higher than the trailing edge. The angle at which the wing hits the air is called the angle of attack. As a pilot, you are in complete control of the angle of attack. By increasing or decreasing the angle of attack, you increase or decrease lift. The greater the angle of attack, the greater the lift, until you reach the point where the air no longer flows smoothly over the wing: this is called a stall. When this happens your aircraft loses lift and will fall out of the sky. Although the stalling angle of attack does not vary with weight, the stalling speed does. It increases slightly as the weight of the airplane increases. This means you need slightly more airspeed to stay above stalling speed in a heavily loaded plane.


Angle of Attack
Is the angle that the wing hits the air. Increasing or decreasing the angle of attack affects lift.

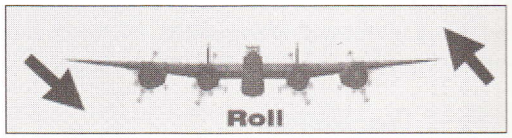
SECTION THREE: PRINCIPLES OF FLYING

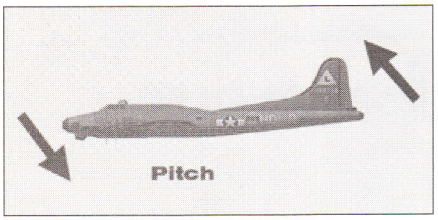
Flight Maneuvers

Flight maneuvers take place around three axes of rotation. These are called the longitudinal, lateral, and vertical axes of flight or roll, pitch, and yaw. The reference point for the axes is the plane's center of gravity. The ailerons, elevator, and rudder create aerodynamic forces that cause the airplane to rotate about the three axes. Ailerons control roll movement along the longitudinal axis. The elevator controls pitch movement up or down in the lateral axis. The rudder controls yaw movement in the vertical axis.

Roll

Applying control pressure to the ailerons causes a change of shape in the aerodynamic wing. This causes the plane to roll left or right on its longitudinal axis. To stop the roll bring the ailerons back to their neutral position.



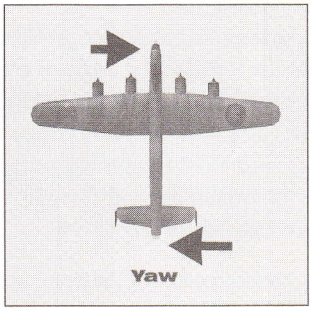


Pitch

The horizontal stabilizer is actually an airfoil. Moving the elevator is quite similar to that of an aileron. When you lower the elevator, the angle of attack of the stabilizer increases, and it produces more lift. The lifting force created by the stabilizer causes the airplane to pivot forward (nose down) on its lateral axis. The net result is a decrease in the angle of attack of the wings and a general decrease in the pitch attitude.

Yaw

Applying pressure on the rudder deflects the rudder into the airstream. This force causes the airplane to rotate about its vertical axis. Pressing on the left rudder causes the rudder to move to the left, changing the angle of attack, thus generating aerodynamic forces toward the right side of the vertical fin. This causes the tail section to move to the right, and the nose of the airplane to yaw to the left.



Trim

Trim is used to relieve control pressures so that the airplane will fly hands-off. Anytime continuous and steady stick (or rudder) input is required to maintain a flight condition, trim can be adjusted so the flight condition is maintained when the stick and rudder are centered.

Aileron trim is used to offset engine torque, so that the plane will not tend to roll off to one side when the stick is released. Elevator trim is used in conjunction with constant power to establish a constant airspeed/pitch condition. Rudder trim is used to eliminate a skid.

Stall Recovery

Flight stalls are more likely to occur during takeoff or climb after takeoff. To recover from a stall, point your nose down and increase power. It is also a good idea to know the flight characteristics of the airplane you are flying. To learn about each plane's characteristics, visit the Training section, where you can test fly each aircraft.

Compression

If you place your plane into a high-speed dive, you may experience a dilemma known as compression. If your plane compresses, you lose control of the ailerons and the elevators. You cannot turn or climb. This occurs because the air traveling over the top of your wings is moving faster than the plane. As your plane approaches the speed of sound, the air traveling over the wings may exceed the sound barrier. This creates shock waves that disrupt the flow of air over your plane, rendering the control surfaces useless. If you begin to experience compression, reduce the speed of your plane immediately. Pull out of the dive if you still have control of the elevators. If you have lost elevator control, cut your throttle and create as much drag as possible (lower your flaps and landing gear) until speed has been reduced to a point where you regain control of the plane.

SECTION FOUR: BASIC FLYING TECHNIQUES

Takeoff

Set the flaps to the down position. Then apply full power to the engine(s) with right or left rudder control to keep the plane straight down the runway. Pull back slightly on the stick when the plane reaches its take-off speed. As soon as possible, retract the landing gear and flaps as you continue to gain altitude and airspeed.

Climb

To start a climb, increase your throttle and point the nose slightly up. The subsequent increase in thrust and angle of attack will generate more lift. Be careful not to bring the nose up too much or you will stall. A sustained climb rate is full throttle, with your aircraft's nose about 20 degrees above the horizon.

Descend

To descend without gaining speed, decrease your throttle setting. The reduction in airspeed will generate less lift, and your airplane will gradually lose altitude. To put your aircraft into a rapid descent pattern or dive, push the stick forward to nose the airplane down into a dive. In a dive, your plane will gain airspeed very quickly and lose altitude rapidly, but be careful not to exceed 500 mph or you risk compression and total loss of your control surfaces.

Turn

To perform a coordinated turn, roll the aircraft in the direction of the desired turn and pull back gently on the stick to apply a slight back pressure. At the same time, apply slight rudder pressure and increase the throttle. Since turning will bleed off speed and lose lift, try to keep the aircraft's nose just above the horizon to maintain the angle of attack.

Landing

The most difficult aspect of flight for the pilot is landing the aircraft. Start your approach at an altitude of 1000 to 1500 feet. Your airspeed will vary depending on the plane you are flying. On initiating the final approach, drop the landing gear and lower the flaps.

Your final approach to the runway should be with the nose of the plane pointed slightly down. Use the throttle to control your descent. As your airspeed bleeds off, you will sink toward the ground. Use the aircraft's elevator to control the speed. If you are coming in too fast, put your nose up slightly to wash off some speed. Remember to carefully watch airspeed during landing. A mistake here can cause you to overshoot the runway or crash just short of it. When you cross the threshold of the runway, you should be at a very low altitude and at just over 100 MPH of airspeed. Just before touch-down, raise the nose of the aircraft slightly. This will drop your airspeed and touch you down onto the runway. At the moment your plane touches down, throttle all the way back and apply wheel brakes, slowing your aircraft to a complete stop.

SECTION FIVE: AIR COMBAT TACTICS

Air combat is about pilot skill, high performance aircraft, ordnance, and aggressiveness. The high stakes, high-speed events unfold about you in three dimensions. You must learn to think in the future while analyzing and reacting to the moment-by-moment action literally exploding around you. To survive this dynamic onslaught, you must be prepared to engage the enemy with a superior skill set—otherwise you will perish.

To prepare you to meet the enemy, this section details basic air combat tactics that include turn rate/radius, energy elements of speed/altitude, and situational awareness. Study these ideas and then go to Section Six where you can put them into practice.

Turn Rate/Radius and Corner Speed

Your aircraft's ability to turn quickly is its turn rate. The turn rate is measured in degrees per second. A related statistic is an aircraft's turn radius, or how tightly it can turn. Note that an aircraft can have a fast turn rate but require a large turn radius. The opposite is also true. These two characteristics are not dependent on each other. Both turn rate and turn radius play a vital role in pursuing an enemy aircraft. If your plane has a tight turn radius, you can learn to use this advantage to win the day in a dogfight.

Turn rate and turn radius are dependent on two variables: airspeed and lift. As your airspeed increases, both turn rate and turn radius improve to a point until maximum lift is achieved. The point where maximum lift occurs with the least amount of airspeed is the corner speed. When you are in a dogfight, you should try to stay close to your corner speed when making turns. This high turn performance will give you an advantage in the fight.

Speed vs. Altitude

Managing your speed and altitude are two essential elements for a successful combat pilot. Maneuvering in the air can decrease one or both elements, resulting in a tradeoff between the two. Altitude (potential energy) is changed to speed by diving, and speed (kinetic energy) is converted into altitude by climbing. Your aircraft possesses both a given amount of kinetic energy (measured by its speed) and some quantity of potential energy (measured by its altitude). This energy translates into maneuverability. If your aircraft has energy, you have more maneuvering options than an aircraft without energy.

Your challenge as a pilot is to learn how to use speed and altitude to keep your plane energized or maneuverable. This requires skill, timing, and practice. If you're closing too quickly on an enemy, you'll overshoot and end up in front of his gun sights. Likewise, you do not want to lose so much speed executing a shake-off maneuver that you lose your velocity advantage. The idea is not to lose your energy advantage. Once you lose your energy, it takes time to recover it—time you may not be able to spare when the enemy is all around you.

Situational Awareness

Being aware of what is going on around you at all times is an essential element to staying alive in combat. You must always know your aircraft's location and speed. You need to know the location of your targets and wingmen. If you're in a dogfight, pay attention to how much ammo you have left. Always monitor your fuel level, especially if you are on a long mission with dogfighting and lots of maneuvering. This can rapidly deplete your fuel reserves. Remember—eyes open and stay alert!

SECTION SIX: TEST FLIGHT

The best way to learn about a particular aircraft in Fighter Squadron is to fly it. Fighter Squadron's fleet of aircraft offers you a wide assortment of aircraft with different flight modeling characteristics. Before you engage in aerial combat, you should perform a test flight in the various fighter aircraft and make note of their different attributes. (Remember these test flight instructions are for the fighters, not the bombers. The heavy bombers were not designed to perform evasive maneuvers.) The following flying fundamentals will help you improve your flying proficiency and give you an advantage when you meet the enemy in the air.

Maximum Speed at Different Altitude

Put the plane in level flight and see how fast it can go. Apply full power to the throttle and notice the difference in performance. A faster sustained speed can make a difference in either overtaking or outrunning the enemy. Be sure to try this at various altitudes.

Acceleration at Different Altitudes

From 10,000 feet at 150 knots, see how long it takes you to get to a higher speed in level flight. Try this experiment again at another altitude. Some planes accelerate better at lower altitude but can not accelerate well at higher altitude.

Acceleration from a Dive

Start from 20,000 feet at 150 knots, dive 3,000 feet, and level out. Check and see how fast you are now going. Slow down to 150 knots and repeat the maneuver. Repeat the maneuver again. Make note of the differences from the various altitudes.

Maneuvering at High Speed

Bring your plane up close to its maximum speed. Now roll it over and notice how much speed bleeds off from this maneuver. Next, pull back sharply on the stick and see how much 'snap' you encounter at the start of the turn.

Corner Speed

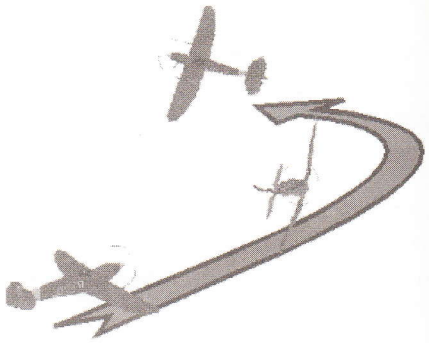
Put the plane into a steady turn. Count how long it takes you to roll the compass from North back to North again. Keep experimenting with various G pulls and speeds until you find the one that takes you around the fastest. Try the experiment again with flaps on and the nose pitched down slightly. This will enable you to find out what works best to get to the best corner speed.

Loops and Half-Loops at Different Altitude

You should attempt loops and half-loops with different degrees of stick pull at different altitude. This will give you some idea about how low you can go before you hit the ground in a loop or how easily the plane goes into a spin. This will build your confidence level in flipping over and reversing at very low altitude. Try these maneuvers with flaps on and off.

SECTION SEVEN: AIR COMBAT MANEUVERS

BRAKE TURN



A basic evasive maneuver used to quickly change direction.

Begin by rolling your aircraft 40 to 60 degrees. Gently pull back on your stick to increase the turn. To maintain altitude, increase your back pressure while reducing the bank angle to raise your nose above the horizon.

BARREL ROLL

A defensive move when an enemy is on your tail. An offensive move when overtaking an enemy too quickly.

Begin a barrel roll by banking sharply to one side while pulling gently back on the stick to maintain rotation about the roll axis. Continue the bank as your aircraft goes inverted. Continue the rotation until you are back in level flight, at the bottom of the roll.

The defensive objective is to have the attacker overshoot and pass you. You must time the maneuver carefully to prevent the pursuing bandit from following you through the turn.

Offensively use the maneuver to wash off airspeed. If you can't lose enough speed, pull back harder on the stick and execute a roll in the opposite direction of the current turn.

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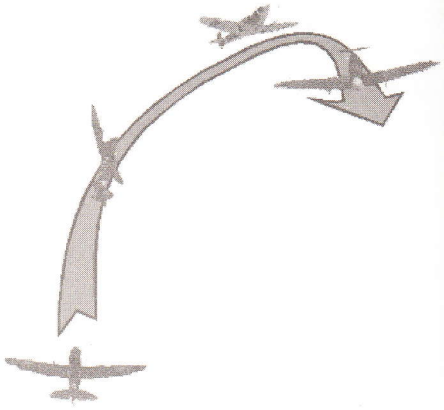


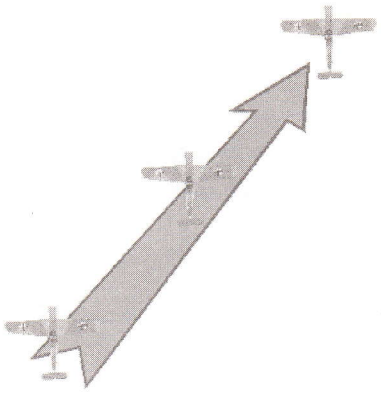
A maneuver for gaining altitude while reversing direction.

Begin from level flight and gently roll the aircraft to one side while applying slight back pressure on the stick. This is a gradual maneuver and should not be performed too sharply. If you bank too sharply, you end up in a Break Turn and lose altitude. Maintain this turn and rising attitude until you have turned 180 degrees.

SKID

A defensive maneuver to throw off an attacker's aim.

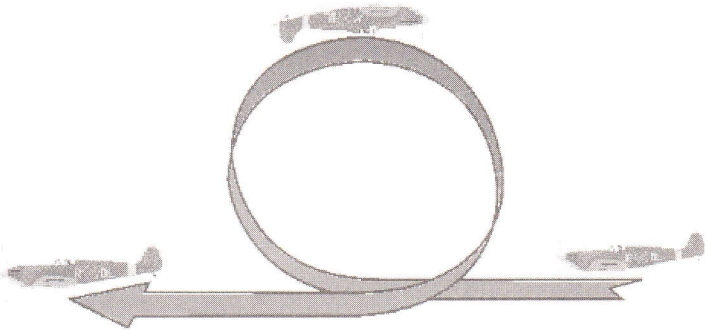
Begin by dipping one wing and applying opposite rudder. The aircraft will skid in the direction of the dipped wing. It can be performed without incurring a large increase in speed or change of direction, and resulting in only a small amount of altitude.



LOOP

Offensive/defensive maneuver.

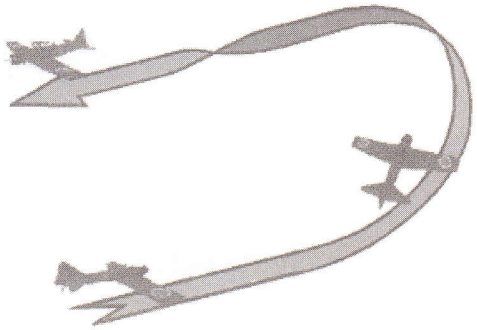
Begin by increasing to full throttle and going into a shallow dive. When you have enough airspeed, pull back on the stick to nose the aircraft up. Your aircraft should be inverted at the top of the loop. Maintain back pressure on the stick until you are back in level flight. When finished, you should be back on your original compass heading but at a lower altitude.



IMMELMAN

Offensive maneuver for setting up an attack.

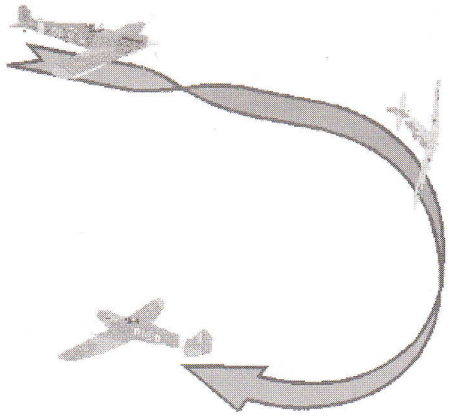
Begin by pulling back on your stick and proceeding to climb. At the top of the loop, your aircraft should be inverted. Apply side pressure to the stick and enter into a roll. Complete the maneuver back in level flight at a higher altitude with a 180 degree heading change.

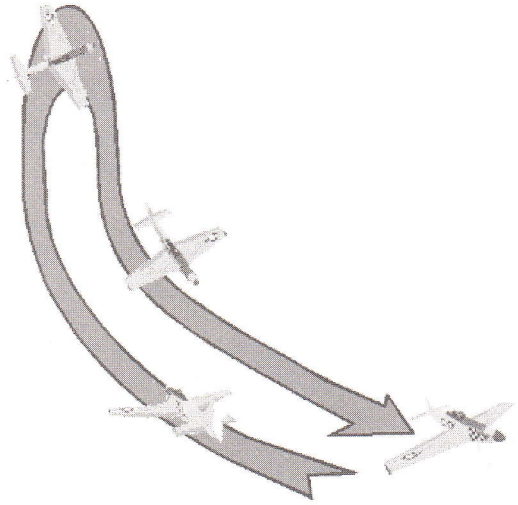


SPLIT-S

Offensive maneuver for attacking enemy at lower altitude and traveling in the opposite direction.

Begin by rolling your aircraft to one side until you are inverted. Reduce the throttle while pulling back on the stick and enter into an inverted dive. Continue to apply back pressure on your stick until you are back in level flight. As soon you are back on level flight, increase the throttle again. Watch your airspeed when diving. If you get too fast you will lose the use of the control systems due to compression.





WING-OVER

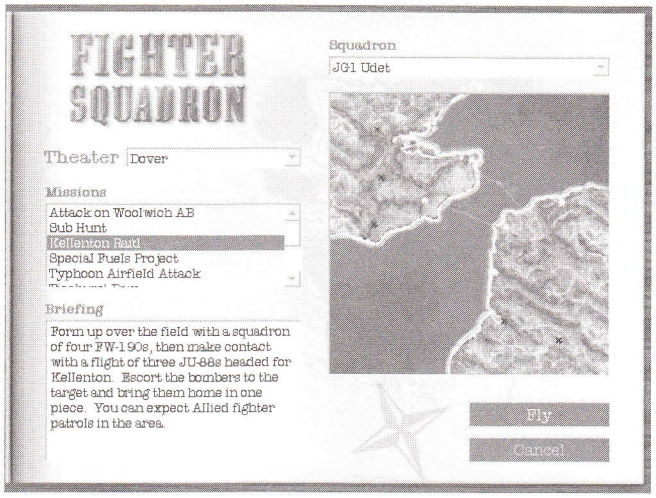
Offensive maneuver for ground attack.

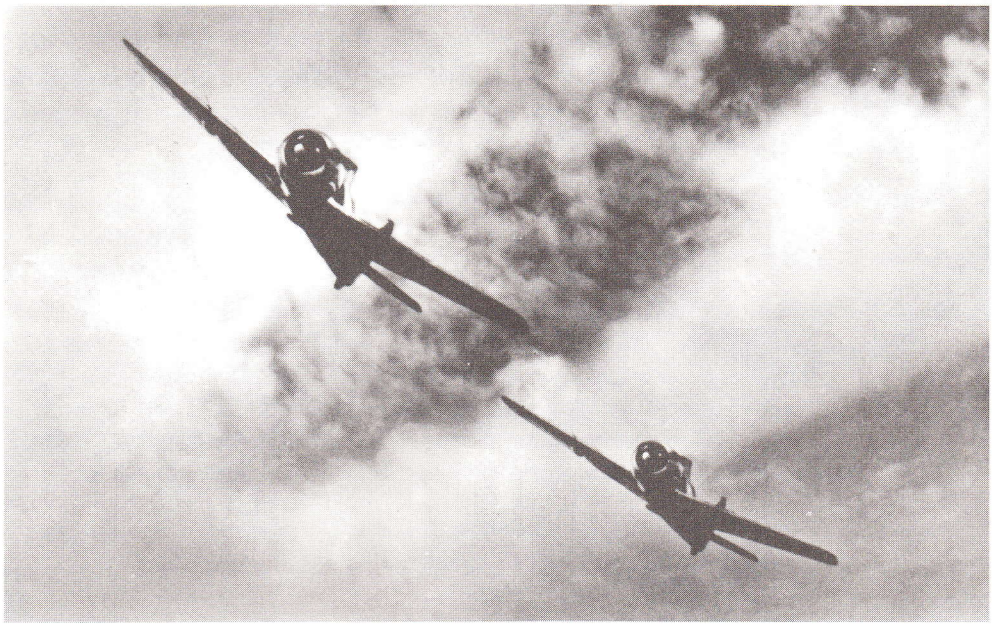
Begin by initiating a climb. At the top of the maneuver you should be close to the stall speed of the aircraft. Rather than use your elevator to perform the 180 degree turn, apply full rudder to yaw the plane over until the nose of the aircraft is pointing downward. Straighten the rudder and reenter the dive.

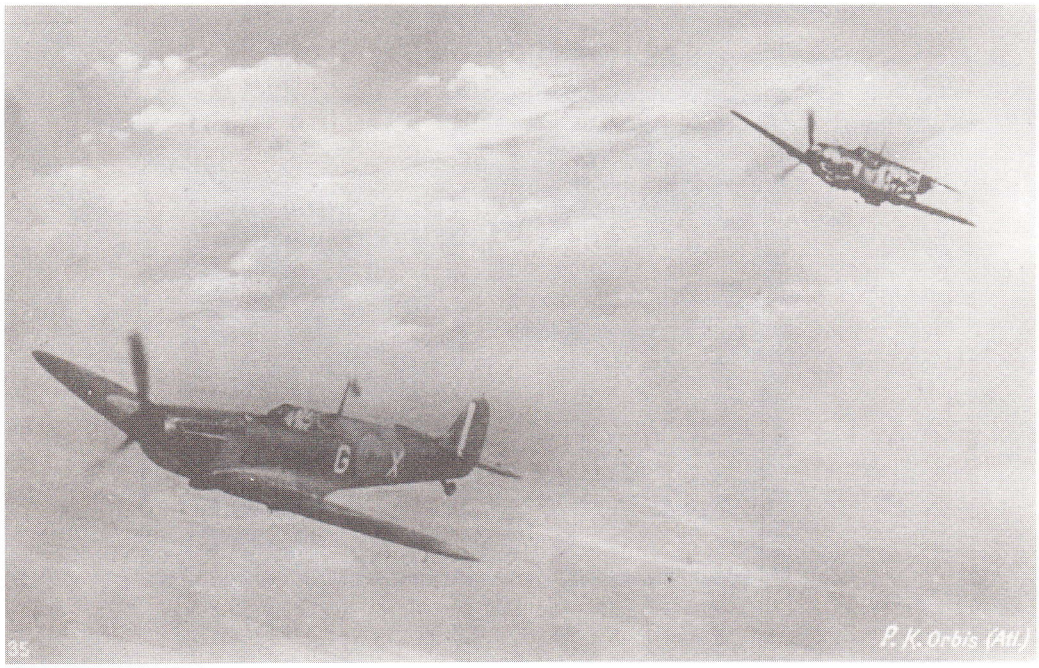
MISSIONS

To start a new game, select **Missions** from the Main menu. Each mission takes place in one of three battle theatres: Dover, Africa, or Rhineland. Select your battle theatre, mission, and squadron. The missions for the selected squadron will be displayed along with a briefing. The following fields are available.

- Theatre — Select from Africa, Dover, or Rhineland.
- Missions — Select a mission from this list.
- Map — This terrain map supplements the mission description by showing your exact starting point and the route you must follow to your target. Clicking on the map zooms to an enlarged view. Note: Fighter Squadron missions take place in a 40-mile-square theatre. All aircraft are constrained within the theatre by strong border winds. As an aircraft reaches the edge of a theatre, the headwind will gradually increase in velocity until the aircraft is no longer able to make forward progress.
- Briefing — Contains a briefing for the selected mission. The information provides you with critical facts necessary to complete your mission successfully.
- Fly — Starts the mission







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MULTIPLAYER/NETWORK PROCEDURES

Fighter Squadron supports network play. Selecting **Network** from the **Main** menu allows you to start or join a network game. The Network screen is where you can configure the type of network connection necessary for your system.

CONNECTION TYPE

INTERNET

Choose this connection type when you will be playing a game against other people over the Internet. After selecting Next, you will be taken to the server selection screen.

Your computer must be properly configured to communicate over the internet prior to playing an internet game in Screamin' Demons.

IPX

Choose IPX when you will be playing a game against other people over a local area network. After selecting **Next**, you will be at the game list screen where you may then create a new game or join an existing one.

Note that you must have IPX installed before you will be able to play an IPX game in Screamin' Demons. Refer to your Windows manual for IPX installation instructions.

TCP/IP LAN

Use this method as an alternative to IPX when you want to play a game over a local area network and you already have your computer set up with TCP/IP.

SERVER

The server screen lists the ActiveLink servers available for play with Screamin' Demons. In order to connect to an Activenet server, you must have a working and active connection to the internet.

Once you've chosen a server by selecting it in the list, you should click on **Next** to go to the lobby screen.

NAME

This is the name of the server.

PING

This is a number which shows how fast your computer can communicate with the server, with lower numbers indicating faster connections. Servers which show 9999 for their ping indicate that the game has not been able to connect with the server. In general, you should join the server which has the lowest ping to increase the likelihood that the game you play will run at top communication speed.

LOBBY

The Lobby screen lists the lobbies which are available on the current server. Each lobby can have 30 people in it at one time, and you may have to try to enter more than one lobby if your first choice is full.

Once you've chosen a lobby from the list, select **Next** to go to the Games screen.

NAME
This is the name of the lobby.

ACTIVE GAMES / CAPACITY
This lists the number of people currently in the lobby and the maximum capacity.

GAMES
This screen lists the currently available games and allows you to chat with other Screamin' Demons players prior to creating or joining a game.

CREATE GAME
Click on **Create** to start a new game. This will take you the Create Game screen.

JOIN GAME
In order to join a game, select one from the game list and click on **Join**. You will then be taken to the Create Game screen where you can set up a new game which other people can join.

USERS
This lists the Screamin' Demons players currently in the lobby.

MUTE
Muting a player filters out his chat messages so that you won't see them. While you shouldn't have to use it often, it is useful in a full lobby when you need to filter out everyone but the people you intend to play a game with.

MESSAGES
This window contains the chat history since you entered the lobby.

SEND MESSAGE
This window is where you type when chatting with other players. When you want to send your message, press return.

CREATE GAME
The Create Game allows you to set the name and password for a game as well as the connection type and game speed.

NAME
This is the name that other players will see in the game list. In general, you should keep the names short and easy to recognize.

PASSWORD
This can be any combination of letters and numbers and is used to limit who can join your game. Any player trying to join your game will be required to enter the password before they will be allowed in. If this window is empty, no password will be required to join your game.

FAST/SLOW NETWORK
You may use the Fast / Slow Connection option to optimize a multi-player game for the network hardware used by you and your opponents. Fast Connection should be chosen whenever you and your opponents/teammates are all running on a Local Area Network (LAN). Slow Connection should be chosen whenever you expect at least one

connecting with a modem or from a long distance on a Wide Area Network (WAN). In general, Fast Connection can be chosen whenever you expect the ping between each player to be less than 100 milliseconds.

The Fast/Slow Connection option adjusts the amount of lag introduced by the game to maintain smooth animation of moving aircraft. Fast connections will exhibit approximately 1/5 second of delay between machines, whereas Slow connections will exhibit a 1 second delay between machines.

REALTIME / 1/2 REALTIME

First of all, the Real-time selection has absolutely nothing to do with the speed of your network connection. The Real-time option allows you to choose whether you and your opponents/teammates will all be running on CPUs fast enough to maintain the required 20 frames-per-second event simulation rate. If a player with a slower machine enters a Real-time game, he/she may notice that their aircraft performance (speed) is reduced compared to other aircraft in the game. 1/2 time runs the game at half speed to maintain optimal performance for slower machines.

MISSION

The mission screen is where the mission and gameplay settings are chosen. The person creating the game and the people joining the game see the same screen, but only the creator (host) can change the game settings. The only exception to this is the squadron list. Each player must choose a squadron and select **Ready** before the game can begin.

SELECT MISSION

Here, the host selects the mission to be used.

SEND MISSION

If any of the other players are missing the mission or have a different version of the mission chosen, the host can click on **Send Mission**, and a copy of the mission file will be sent to each player that needs it.

This button is only available to the person hosting the game.

SELECT SQUADRON

Before the game can begin, each player must select a squadron from this list. If the squadron is full (i.e. all planes in the squadron have already been chosen by other players), you will have to choose a different squadron. As each player chooses a squadron, their name will be moved from the **No Squadron Chosen** group to the squadron they've selected.

EJECT

This allows the person hosting the game to kick out any unwanted players by double-clicking on their names. The unwanted player will then be kicked out of this screen and removed from the player list.

OPTIONS

This list displays, and the host may change, gameplay options such as G-force effects, infinite ammo, free-for-all play, etc.

LOCK GAME

The host may lock a game so that other players may not join. You may need to select this if all of your friends have joined your game, you're on a busy lobby, and you want to keep other people from joining your game.

MISSION BRIEFING

The mission briefing in network games is identical in behavior to the single-player briefings.

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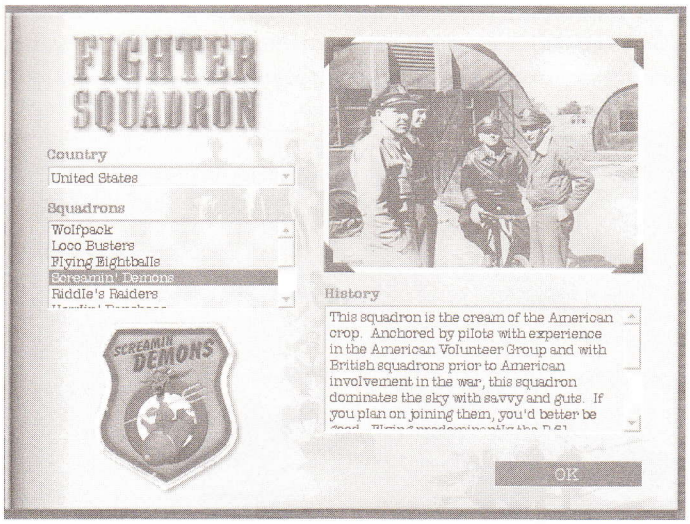

This is where you review details about various squadrons.

The following fields are available:

- **Country** — Select from Britain, Germany, or United States.
- **Squadron** — The name of the active squadron is displayed. The pop-up menu lists all squadrons in the game.
- **Squadron Logo** — Displays the patch worn by pilots in that squadron. The patch changes when you select another squadron.
- **Squadron History** — The squadrons history is displayed in this area.

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HANGAR

The Hangar is an interactive reference for the aircraft in *Fighter Squadron: The Screamin' Demons Over Europe.* The Hangar is a great place to learn about the performance and features of the aircraft flying in this simulator. In the Hangar you also get an opportunity to take a quick test flight to help familiarize you with each aircraft.

Country

The first step in using the Hangar is to select an available country from the list. The available aircraft for that country are displayed in the scrollable list.

Aircraft

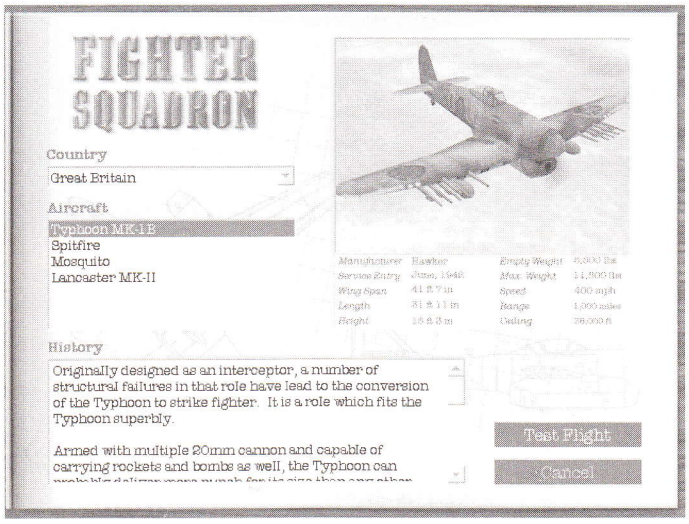
Germany	**United Kingdom**	**United States**
Focke–Wulf Fw–190A4	DeHavilland Mosquito Mk V	North American P–51D Mustang
Messerschmitt Me–262A	Avro Lancaster Mk II	Lockheed P–38J Lightning
Junkers Ju–88A4	Hawker Typhoon Mk I	Boeing B–17G Flying Fortress
	Spitfire MKIIb	

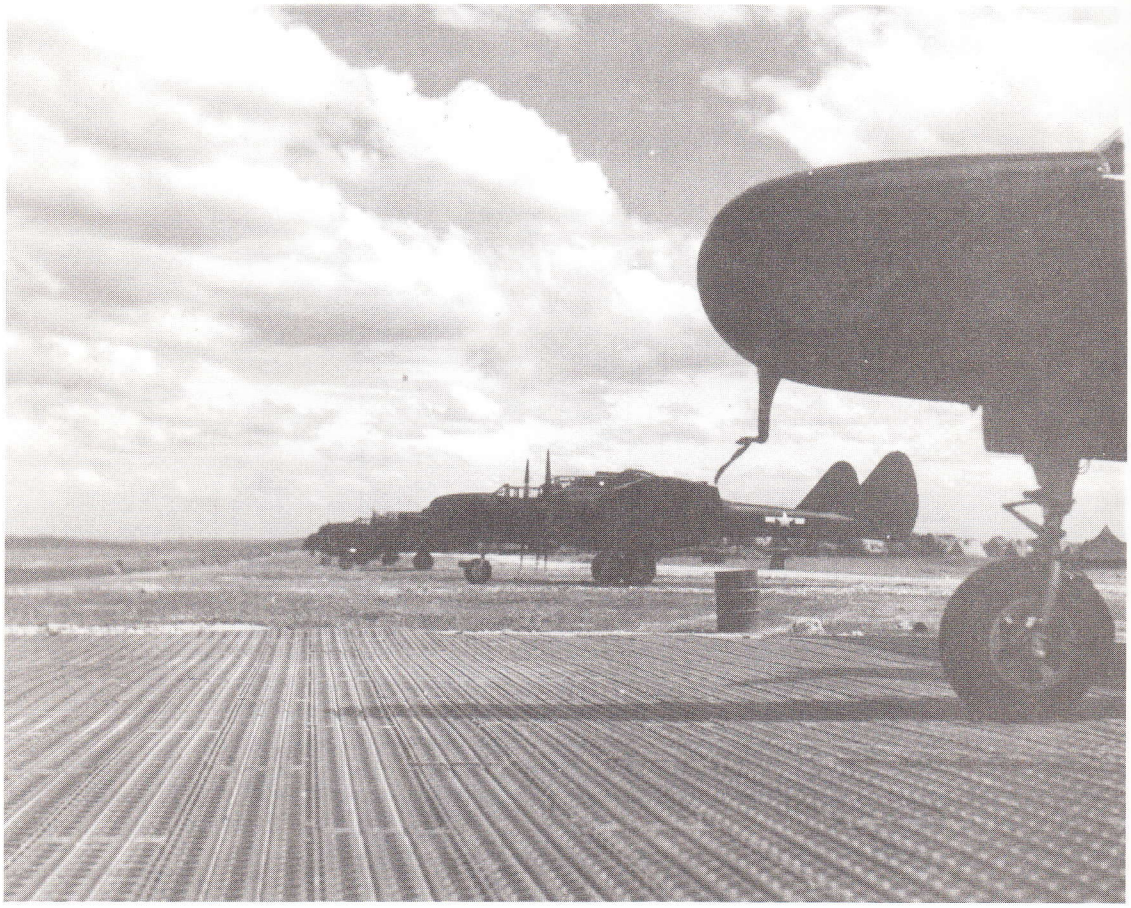
History

A brief history of each aircraft is displayed when that aircraft is selected.

Test Flight

Choosing **Test Flight** from the menu places you inside the cockpit of the selected aircraft. The plane is parked at the end of a runway, ready for you to taxi and takeoff. You get to fly the aircraft in an enemy-free environment to help acquaint you with the particular characteristics of the aircraft.





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SIMULATOR

Interactive Cockpit

To interact with the instrument panel, you must be in the Internal Mode – Pilot View. All cockpits are modeled from the original aircraft. **Note**: The following guages are found on American planes. Some guages on the British and German planes will differ slightly. The following instruments are functional:

Altimeter – Displays the altitude of the aircraft above sea level in feet.

Airspeed Indicator – Displays airspeed in m.p.h., and kph depending upon the plane.

Vertical Speed Indicator – Displays how fast you are going up and down.

Attitude Direction Indicator – or Artificial horizon, provides a pictorial display of the aircraft pitch and bank attitude relative to the horizon.

Engine RPM – Displays engine performance.

Flap Indicator – Indicates flap position.

Gear Indicator – Green indicators are displayed when the gear is down and locked. Displays red when the gear is retracting or is damaged.

Magnetic Compass – Displays the magnetic heading of the aircraft.

Fuel Gauge – Displays the level of fuel remaining in the tanks.

The following cockpits instruments are also animated: Gas Pressure/Temperature, Voltmeter, Hydraulic Pressure, Air Temperature, Carb Air Temperature, Oil Pressure, Oil Temperature, Fuel Pressure, and Manifold Pressure.

CONTROLS

The following controls are functional:

Ailerons — The ailerons are the trailing edge of the outboard wing sections. Ailerons move in the opposite direction to cause the aircraft to roll. To roll left, move the **joystick to the left**. To roll right, move the **joystick to the right**.

Elevator — Positioned along the trailing edge of the horizontal stabilizer on the tail of the aircraft. Deflecting the elevator up causes the aircraft to pitch nose up. Moving the elevator down causes the nose to pitch down. Pull the **joystick back** to pitch up. **Push forward on the joystick** to pitch down.

Rudders — The rudders are along the trailing edge of the tail. Deflecting the rudder to the left causes the nose to yaw left. Deflecting to the right causes the nose to yaw to the right. Use the **> key** to yaw to the right, use the **< key** to yaw to the left. Full rudder deflection requires five successive keystrokes in the same direction.

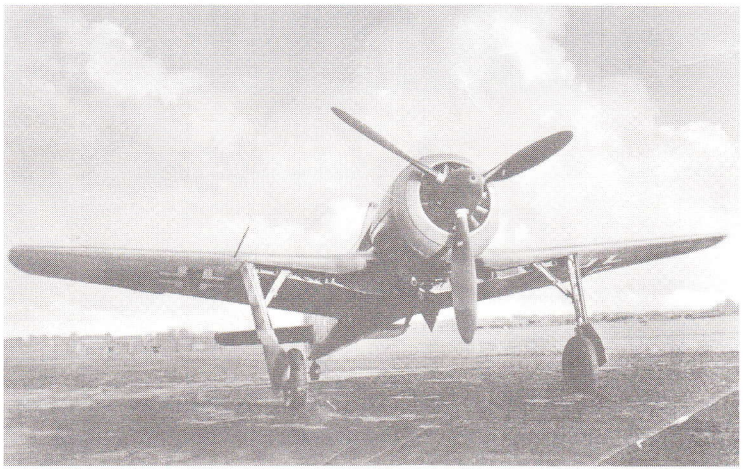
Flaps — Located along the trailing edge of the inboard wing sections. Flaps increase the amount of lift generated by the wing and are lowered for take-offs with heavy loads. Flaps are required on landing since they reduce landing speed. Most Fighter Squadron aircraft have two notches of flap control. Extend or retract flaps one notch by pressing the **F** key for down and **Shift-F** for up.

Throttle Setting — Throttle settings for all engines are controlled by the same keys. To start engines, press the **E** key. To increase throttle settings, hold down the **+** key until the required throttle setting is achieved. To reduce throttle setting, hold down the **–** key. Press **E** to turn the engines off.

Undercarriage — The steerable nose wheel is controlled by aileron or rudder input, depending upon the Options chosen. Once airborne, press the **G** key to retract the undercarriage. If the landing gear becomes damaged, it may not deploy. A hard landing may damage the landing gear.

Bail Out — To get out of a damaged aircraft, press **Ctrl-E**.

Bombs/Rockets — Press **A** to arm. Select Rockets with **4**, pylon bombs **5**, and bomb bay with **6**. Open the bomb bay doors by pressing **D**. Press **Enter** to release.



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CREW POSITIONS

Pilot — From this position you are in control of the aircraft. If you move to another location in a multi-crew aircraft, control of the aircraft reverts to the autopilot.

Bombardier — When you take this position, you control bomb release. There is a crosshair on the screen, which is an immobile CCIP impact point reference. You will need to practice bomb runs and adjust your aim based on altitude (above the ground), airspeed, wind, and aircraft pitch. Use the tick marks on the crosshair to estimate the actual bomb impact point based upon your experience. This marks the point of bomb impact.

Gunners — In a turret location, you control the traverse and elevation of the turret using the same "inputs" that control aileron and elevator control. The viewpoint always follows the direction in which the turret rotates but can be moved independently of the turret with the numpad keys.

VIEWS

There are three Views in Fighter Squadron and several View Commands. The primary views are:

- **Internal Mode – Pilot View**

  The pilot or crewman's eyepoint. This view simulates head motion. It supports zooming that affects the field of view and magnification. If the aircraft has multiple crew positions, you can move between available eyepoints and operate equipment available at that station. Internal views are available if that aircraft is functional and someone in the plane is still alive. If you get killed, you are automatically moved into an external mode chase view.

  View Commands
  Crew Position (**F7**): Moves to other eyepoints in the aircraft. To take control of that position, press **F6**.
  Padlock (**F1**): The padlock modifier locks the view to the currently designated aircraft.
  Target (**T**): Cycles targets in Padlock Mode.

  View Modifiers
  Zoom (**[or]**): Zooms in or out.
  Shift with numpad: Moves eyepoint in any direction.

- **External Mode**

  Places your eyepoint outside the aircraft. You can zoom to any position outside the aircraft. The three types of External Modes are the following:

  - Freeform (**F2**): The eyepoint is not locked to the aircraft and the plane rotates while the world remains fixed.
  - Fixed (**F2, then numpad 5**: The eyepoint is locked to the aircraft, and the world rotates while the plane remains fixed.
  - Chase (**F3**): Similar to freeform view, except the view follows the aircraft motion with a slight lag. This results in very dramatic and cinematic style of sweeping view.

View Commands
Next Plane (**F5**): Moves the external viewpoint to the next plane in the squadron.
Padlock (**F1**): The padlock modifier locks the view to the plane currently designated aircraft.

View Modifiers
Zoom ([**or**]): Zooms in or out.

External Mode – Weapon View
(**F4**) This view follows the last rocket or bomb released from the aircraft.

OVERLAYS

The overlay displays various kinds of information during the game. Each section of the overlay can be invoked by a hot-key. The overlay sections are:

Identity (**Alt + I**) The identity displays both the squadron and the pilot name in the top left corner of the screen. When you change to an AI type of external view, the identity gives specifics on that particular view.

HUD (**H**) The HUD is a user aid and displays all of the primary flight information in a moving scale display. The basic components of the HUD are the flight ladder, airspeed, velocity, and heading.

Radio The Radio overlay displays the three most recent text messages transmitted by radio. To issue a radio message, enable the command line, enter the message, and then exit. Messages are tagged by your callsign. To start a new message, press the **accent grave** (`) key. This activates the text entry mode, and you can enter your message.

Target (**Alt + M**) The Target overlay is used to show the position of all ground targets and airfields. As you change headings, the targets rotate in relationship to the aircraft's new heading. Objects that appear directly in front of the aircraft icon are directly ahead of your aircraft. The three rings around the aircraft represent equal distance increments and give some idea of relative distance between the aircraft and the ground objects. You can change the scale of the map to two mile, five mile, and ten mile increments.

Weapons (**Alt + W**) Identifies what weapon is on a particular pylon.

Multi-player Score (**Alt + I**) Displays the current score for all players in a multi-player game.

In Flight Map Press **M** for full view or **Shift M** for a close up view of the area near your plane. Your plane is yellow, enemies are red, friendlies are green. Airplanes are airplane icons, land units are tank icons, sea units are ship icons. Your plane's waypoints are listed by number in black.

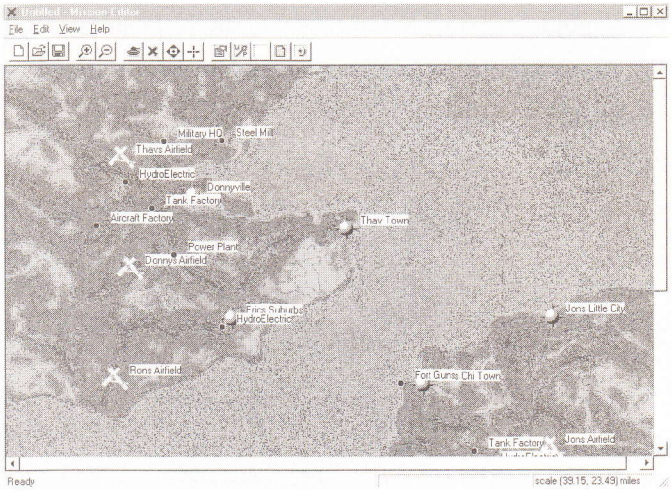
MISSION EDITOR

OVERVIEW

The Mission Editor is used to generate new missions for the game. The editor is a combination stand-alone program that works outside of the game. If you have a good understanding of how the game works, then it should be an easy process to create new and unique missions to enhance gameplay.

The editor consists of a map of the database where you work with existing fixed objects (airfields and targets), and also create new mobile objects (aircraft and ground vehicles).

(Note: Activision Customer Support can not provide assistance on the Mission Editor.)



MENUS/TOOL BAR ITEMS

File Menu

New	Creates a new mission (Ctrl-N)
Open	Opens an existing mission file (Ctrl-O)
Close	Closes the existing file
Save	Saves the current file (Ctrl-S)
Save As	Save the current mission file with a different path or file name. Multiplayer missions must be saved in the Media\Missions\Multiplayer folder. These folders are created on your hard-drive when you install Fighter Squadron and can be found in the folder where you chose to install Fighter Squadron. You may also create other folders in the Media\Missions folder to hold any single-player missions you create.
Recent File	Keeps a record of your most recent files
Exit	Exits the Mission Editor

Edit Menu

New Squadron	Allows you to create a new squadron and place them into the combat theatre with properties that you create. (Shift-S)
New Waypoint	Allows you insert waypoints into the mission with the following controls: ■ Waypoint Control: Auto/Escort ■ Start Point: En Route or Airfield that you specify ■ Start Conditions: Altitude, Velocity, Headquarters (Shift-W)
New Ground Unit	Allows you to place a new ground unit and adjust the properties
Delete	Deletes the current selection. (Del)

View Menu

The following Views are available in the View menu:

Properties	Allows you to view and edit the properties for the selected object (**Ctrl-1**)
Waypoints	Allows you to view and edit the properties for the selected waypoint (**Ctrl-2**)
Environment	Allows you to view or set the date, cloud cover, wind direction, and speed (**Ctrl-3**)
Briefing	Allows you to create you own mission briefings (**Ctrl-4**)
View Filter	Allows you to filter the following in any combination: (**Ctrl-5**)
	Allied, Axis, Squadrons, Waypoint, Ground, Units, Airfields, Towns, Targets, and Labels

Tool Bar

The tool bar attached to the Mission Editor window contains the various tools necessary to work within the Mission Editor. The tools are New, Open, Save, Zoom In, Zoom Out, New Ground Unit, New Squadron, New Waypoint, Nav Tool, Properties, Waypoints, Environment, Briefing, and Filter.

Waypoint Tools & Editing

Waypoints for aircraft and other objects capable of following waypoints are created using the New Waypoint tool.

Creating Waypoints for an Object

To create a waypoint you must use the Waypoint tool. First click on the object that you desire to modify its waypoint. If the object can have waypoints, its icon will highlight. Wherever you click on the map will establish a new waypoint for the object. It is also possible to add more waypoints at a later editing session. No object can have more than 20 waypoints.

Deleting Waypoints

To delete a waypoint, select the waypoint and right-click to delete the waypoint. That waypoint and all commands associated with it are deleted. As waypoints are deleted, the waypoints along the edited path are renumbered.

Moving Waypoints

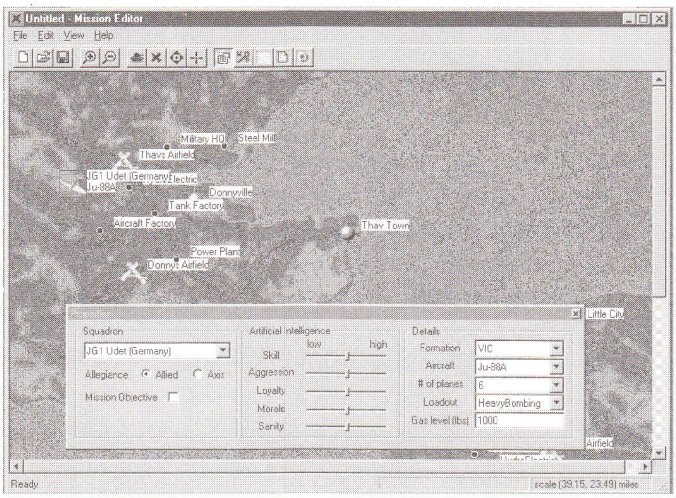
Waypoints can only be moved one at a time.You can drag waypoints to new locations.

Nav Tool

The navigation tool is used to measure the distance and heading between any two points on the map. To use it, select the Nav tool from the toolbar icons. Click on the map to designate the start point and drag the cursor in any direction to get the bearing and distance to that location. If the required location is beyond the boundary of the window, the window automatically pans in the same direction as the line that connects the origin to the end point of the Nav tool. The distance and bearing are updated in real-time and are displaced in the bottom of the window. Cancel the Nav tool with a right mouse click.

CREATING NEW MISSIONS

To create a new mission select New from the file menu or the New icon on the toolbar. This action will bring up the Choose a Map window. Once you have made your selection and the map loads, you can begin making changes. Placing a new squadron, ground unit, or waypoint are all accomplished from the Edit menu or the toolbar. Once you have selected an item, you can place it anywhere on the map. Once the new object is in place, the Properties dialog box will open for you to set the various properties associated with that object. **Note**: If you wish to change the name of an already existing custom mission, do this within the Mission Editor, only.



After you have placed a new squadron in the map, the Properties window opens for editing. The window contains the following areas for editing.

Squadron

- Squadron: Drop-down menu listing available squadrons for this combat theatre.
- Set the allegiance of an object to either Allied or Axis. The default is Allied, which can be changed by the allegiance buttons. There are no restrictions on which aircraft can be selected on either side. It is possible for a squadron of captured Me-262s to attack Ju-88s.
- Mission Objective: If you select the check box, a Destruction Factor menu item becomes available. The setting is between 10% and 100% destruction before the squadron or vehicle can receive points.

AI

The squadron AI contains five parameters that determine how effective a unit behaves. Since all objects in the game use these parameters, it will allow you to create a wide range of interesting behaviors. All parameters are from low to high:

- **Skill** — Can't hit the broad side of a battleship to can shoot a cigar out of someone's mouth from 5,000 feet
- **Aggression** — Poodle to pit bull
- **Loyalty** — Bails for a hang nail to go down with the ship
- **Morale** — Dispirited and depressed to gung-ho
- **Sanity** — A-few-short-of-a-six-pack to perfectly sane (well, as sane as a pilot can be)

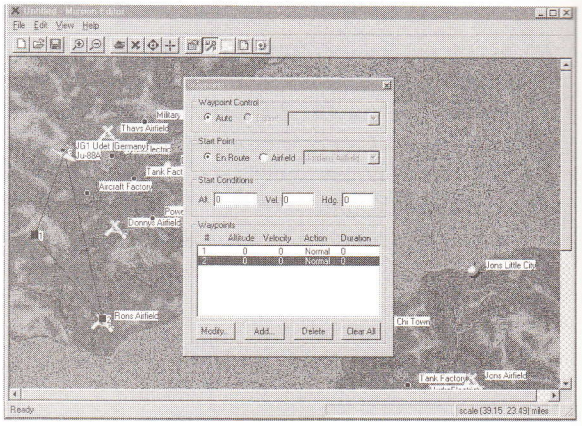
Details

The parameters that make up the details section of the property window are dependent on the type of object. There are five categories of detail type. These are for aircraft, ground vehicles, sea vessels, and immovable database objects such as airports and targets. Each parameter has a list of variables built up from information known about the type of object. For example, squadrons are defined by their formation type, number of aircraft, and aircraft type. Once the aircraft type is known, it is possible to select a loadout and the amount of fuel that the aircraft will carry. The spatial sequence of these parameters reflect the fact that the options available for subsequent selections are dependent on the previous selections. The following list of options is available in the details section of the property window for the different object types:

- **Formation** — VIC, Wedge, Line abreast, Line astern, Stack
- **Type** — All aircraft
- **Number** — 1-9
- **Loadout** — Guns, Guns & Rockets, Light Bombing, Heavy Bombing (depending on aircraft)
- **Gas** — 500 lbs, 1000 lbs, 1500 lbs

Waypoint Window

After you have placed your squadrons and waypoints on the map, you must give each set of waypoints some properties. First, select the waypoint for editing. Then either **right-click**, or select **Waypoint Properties** from the **View** menu item (**Ctrl-2**) or the tool bar icon.
All squadrons follow a set of commands during a mission. The command set may be very simple to quite complex. One very important distinction that must be made at the beginning of mission planning is whether the aircraft is acting autonomously or following another squadron. Following another squadron would be indicative of an escort mission. In this way a link is established between separate entities.



The Waypoints window will open for you to edit the properties. Your options are:

Waypoint Control

Auto Sets the squadron to autonomous control. If waypoints have been set, then the aircraft will follow the waypoints and execute all action commands specified for the squadron.

Escort Sets the squadron in escort mode. This requires you to specify another squadron to escort. Selection of the squadron to escort is available via a pop-up listing. When Escort is selected for a squadron, it is not possible for another squadron to escort the escorting squadron.

Start Point

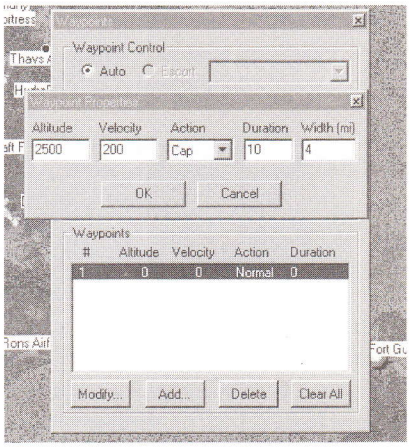
The start point defines exactly where the aircraft appears when the mission starts.

En Route The aircraft starts at the exact position indicated on the map. The aircraft will appear in the database with all the specified start conditions.

Airfield Aircraft placed at airfields will taxi to the runways and then take-off under AI control. Once the aircraft are airborne, they will fly at the altitude and velocity specified in the start conditions. If the aircraft have no waypoints, they will fly in the specified heading.

Waypoint Properties

Aircraft only respond to commands when they reach a waypoint. The following is a list of commands that the aircraft will respond to at any new waypoint:



Number The number of the waypoint itself. This number refers to the number that is listed next to the waypoint in the map window.

Altitude Sets the altitude for the next leg of the flight. If the altitude is set too high for the aircraft type, then the aircraft will travel at the maximum possible altitude.

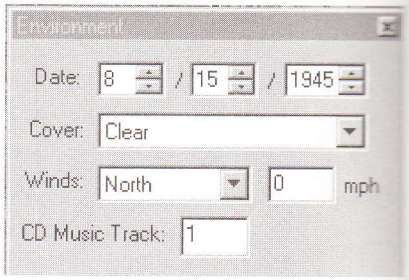
Velocity Sets the velocity for the next leg of the flight. If the velocity is too high for the aircraft, then the aircraft will travel at the maximum possible speed.

Action Sets the action that the aircraft carries out on the way to the next waypoint. The waypoint actions are:
Normal – Directs the AI pilot to fly to the next waypoint. He will not attack enemy units unless attacked.
Combat Air Patrol (CAP) – Directs the AI pilot to engage any enemy aircraft in the patrol area.
Sweep – Directs the AI pilot to engage any enemy aircraft or ground unit in the patrol area.
Bomb – Directs the AI pilot to bomb any enemy ground units or targets in the target area.

Duration Some actions require a duration to define the period of time that the squadron is engaged in a particular activity. For example, when a squadron flies CAP or Sweep, the number of circuits, or the time on station (in minutes) must be specified.

Width This specifies in miles the width of the area to be covered by the behavior set in the Action panel.

Environment Window



The Environment Window is used to set the environmental factors for the mission itself. Such factors include time of day, winds, and clouds.

Date

The date field is important since it determines the order in which missions are listed. It is possible to create a quasi-campaign by sequencing a series of scenarios with an assumed outcome. The date setting has no effect on the seasonal features of the terrain.

Cloud Cover

The cloud cover is set via a pop-up menu. The menu choices are:

Clear
Partly Cloudy
Cloudy
Overcast

Winds

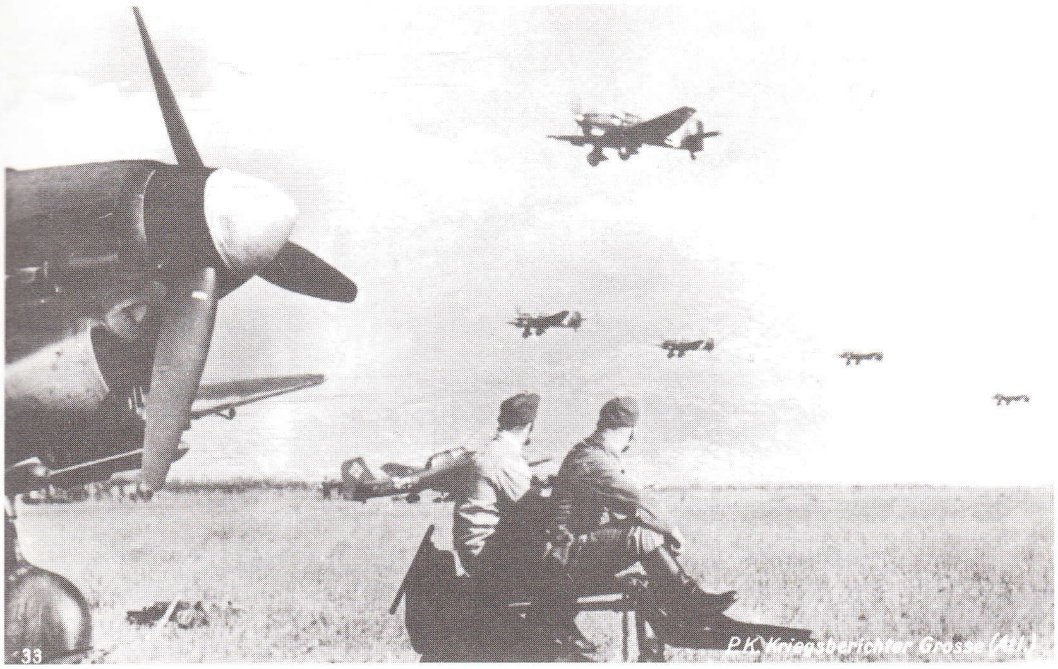
The wind is set via pop-up menu. Since winds are not constant in nature, this is reflected in the simulation by variable wind speeds and direction. The menu choices are:

Winds Wind direction in degrees

MPH Wind speed in miles per hour

CD Music Track Which track to play

The following example illustrates the importance of these properties: an Axis factory is tagged as a primary objective with a destruction factor of 50%. Once the factory has attained 50% damage, all Allied players are notified that victory has been achieved and that they can return to base. Similarly, if an Allied squadron of nine bombers was tagged as a primary objective with a destruction factor of 50%, then five aircraft from the squadron must be downed before the Axis pilots are notified of their victory. If both are on the same mission, the victory goes to the one who first satisfies the primary objective. There is no limit to the number of primary objectives assigned in a mission.



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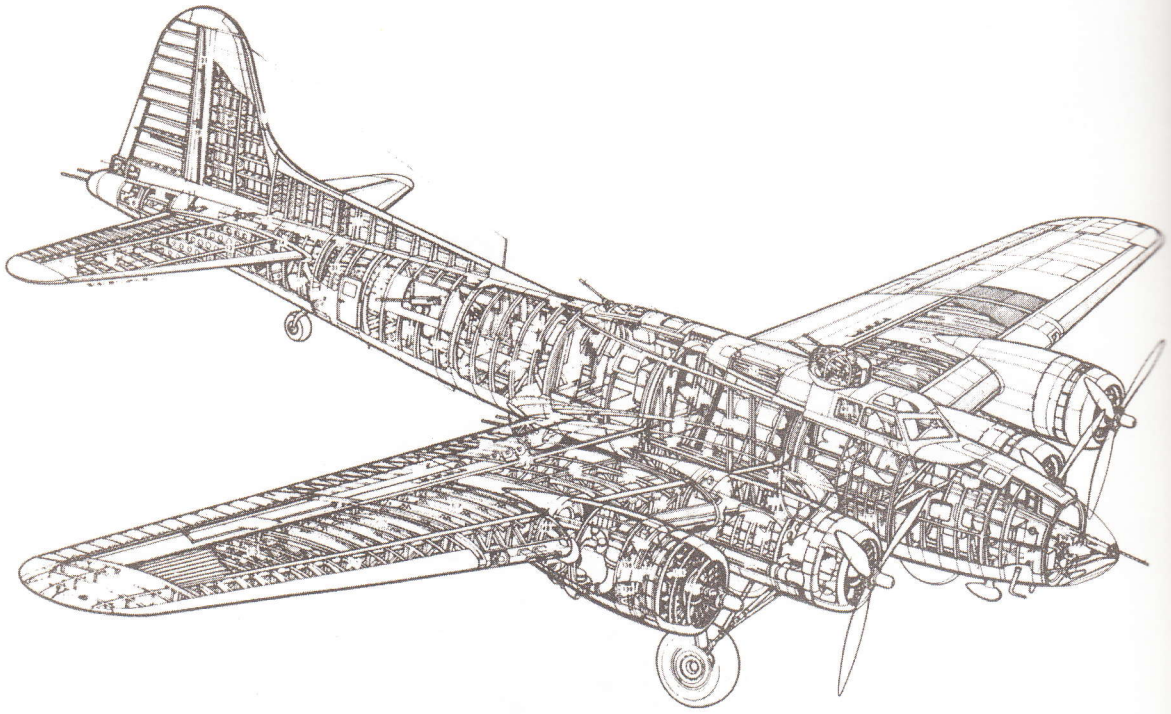


B-17G Series Specifications:

Wingspan:	103 ft. 9 in.
Length:	74 ft. 9 in.
Height:	19 ft. 1 in.
Weights	
Empty:	36,135 lb.
Loaded:	65,500 lb.

Performance:

Maximum Speed:	302 mph
Range:	3,400 miles
Service Ceiling:	35,600 ft.

Armament: Thirteen –.50–cal. machine–guns
Bomb Load – 6,000lb.

Power Plant: Four – 1,200 hp 9–cylinder Wright R–1820 "Cyclone" radial engines

Fuel Capacity: 16,728 lbs.

Accommodation: Ten – Pilot, Copilot, Navigator, Bombardier, Radio Operator, Ball Turret Gunner, Bottom Turret Gunner, Tail Gunner, (2) Additional Side Gunners

AIRCRAFT HISTORY

UNITED STATES

Boeing B-17G Flying Fortress

In response to the growing world unrest in the 1930s, the U.S. Army Air Corps called for a contest to build a multi-engine bomber to be used in coastal defense. Considering the deep isolationist sentiments of the United States at that time, this was the only way possible to get appropriations approved to build a new bomber. Designated Project 299 at Boeing, company designers conceived a revolutionary four engine approach to create this new aircraft. Based upon the Model 247 civilian transport, the prototype rolled out on July 28, 1935 for its maiden flight. The prototype showed its real potential a month later by flying nonstop 2,110 miles in nine hours. When the prototype crashed on a later flight, it appeared that a converted Douglas airliner might win the contract. But the promise of this new aircraft brought an initial purchase of 13 planes. On seeing the plane roll off the Boeing production line, a reporter dubbed it the "Flying Fortress." The name would stick, and the plane would become the most recognizable symbol of American air power for the war.

Following a number of improvements that included engine superchargers, more armor, and better defensive armament, the aircraft was ordered into production. First combat action with the RAF in July 1941 met with dismal results. Boeing and the Army Air Corps immediately redesigned the defensive armament and the tail section to improve bombing accuracy. Continuous revisions were made to the bomber until it reached the main production version of the B–17G.

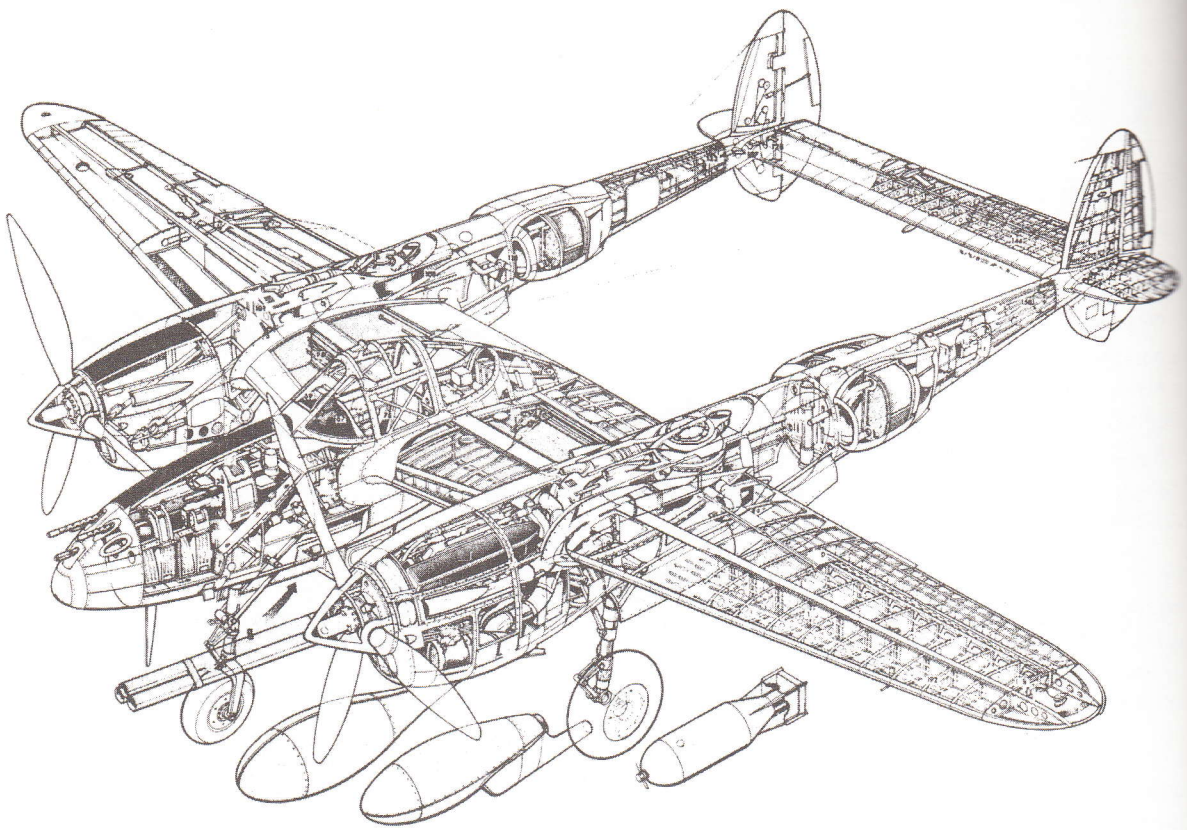
In their primary offensive role during the war, the B-17 bombed strategic targets with a variety of explosive and incendiary bombs. External wing racks were used occasionally but mostly for special weapons. During the course of the war, the fundamental strategy employed was the same – daylight high-altitude bombing using large formations of aircraft.

Toward the end of 1943, the Luftwaffe pulled back all its fighters to defend Germany. This tactic allowed them to put up a thousand fighters at once. This resulted in enormous losses for the Eighth and Fifteenth Air Forces since the bombers went in during daylight without fighter escort. Personnel losses totalled almost one hundred thousand men. The terrible losses could have been larger, but Boeing had ingeniously constructed a durable aircraft. The intricate fuselage fabrication allowed one structural segment to assume the stresses of neighboring segments should that piece get shot away. These durable aircraft could bring home their crews despite heavy battle damage.

In 1943 the tide of battle began to turn due to new, extended range fighters able to escort the bombers to Germany and back. By the summer of 1944, attacks by Luftwaffe interceptors on the bombers decreased to the point that many B-17 gunners completed their tour of 30 or more combat missions without ever firing their guns in action.

However, with the demise of German fighter defenses a new threat arose to menace the bomber streams – radar controlled anti-aircraft weapons. The advent of radar controlled flak weapons brought 88mm and 105 mm shells exploding with great accuracy even at 6 miles up. Many targets were defended by as many as 300 flak guns. But once the Allies gained command of the skies, the continuous bombing of the Third Reich reduced even this threat to ruins.

During the course of its production, over 12,000 aircraft were manufactured from various assembly facilities across the United States. Production ended in May 1945.



P-38J Series Specifications:

Span:	52 ft.
Length:	37 ft. 10 in.
Height:	12 ft. 10 in.
Weight	
Empty:	12,800 lb.
Loaded:	17,500 lb.

Performance:

Maximum Speed:	414 mph
Range:	900 miles
Service Ceiling:	40,000 ft.

Armament:
Four – 50–cal. Browning machine–guns
One – 20 mm Hispano AN–M2C cannon in nose
Bomb Load – 2,000 lb.
Fourteen – Underwing rockets

Power Plant: Two – 1,600 hp 12–cylinder Allison V–1710 inline engines

Fuel Capacity: 2,460 lbs.

Accommodation: One

Lockheed P-38 Lightning

The distinctive Lightning was designed in response to the US Army Air Corps request for a high–altitude interceptor. The term "fighter" was not used in the aircraft's specification for fear ofa funding backlash from the isolationist congress. What the specifications did spell out was for a minimum true air speed of 360 mph at altitude and to climb to 20,000 feet within six minutes. To meet these specifications would require breakthrough advances in both airframe design and engine power.

Lockheed's Model 22, subsequently the XP-38, was a radical approach that resulted in a large twin engine aircraft. The Air Corps approved the design, and a prototype was built. When completed, the aircraft utilized a tricycle landing gear, high wing loading, Fowler flaps for low-speed handling, a bubble canopy, and metal-covered control surfaces—a truly revolutionary aircraft in all aspects.

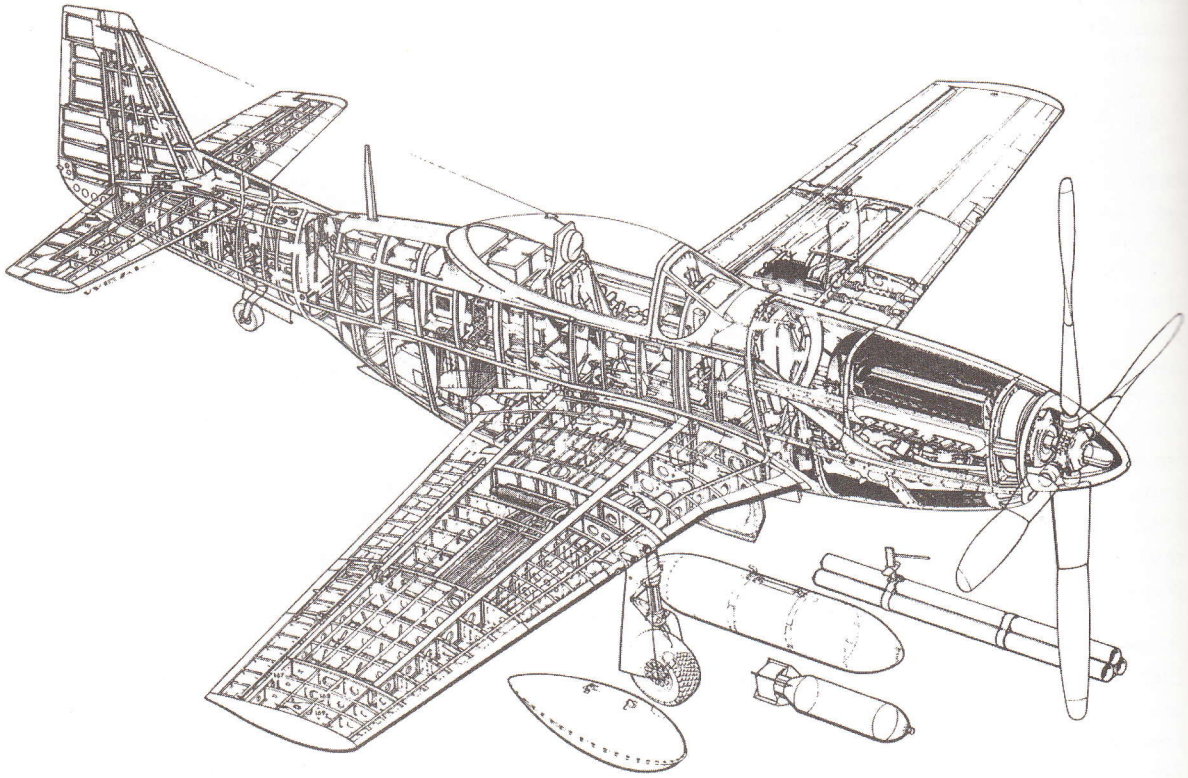
The prototype XP–38 flew for the first time on January 27, 1939. Many minor problems plagued the aircraft, but the Army Air Corps was so delighted with the new "interceptor" that General "Hap" Arnold lifted security from the plane. He was determined to show the world that the U.S. still had a first-rate aircraft industry. Preparations were made for a coast to coast crossing. On February 11, 1939, the prototype flew a transcontinental crossing in seven hours and two minutes. However, the minor problems that had initially plagued the aircraft caught up with her, causing the pilot to undershoot the runway and crash. General Arnold was so impressed with the plane that he took the uninjured pilot to Washington the next day to tell top-level people about the plane. Although the prototype was written off, the stunt had the desired outcome. Thirteen prototypes were produced and exceeded all expectations. However, two major problems plagued the aircraft: tail buffeting and compressibility. Only through wind tunnel tests was it discovered that a turbulent airflow was created by the junctures of wing and fuselage. This problem was corrected by the installation of wing fillets. But compressibility remained to plague the aircraft.

It wasn't until October 1942 that a P-38 was tested at NACA's Ames Laboratory wind tunnel. There it was discovered that the wings generated a shock wave that immobilized the control surfaces. Now that the U.S. was at war and production was all-important, special dive brakes were designed to go under each wing. Finally, some 14 months later, Lockhead incorporated the modification into aircraft production. By that time more that half of all P-38s had been produced.

Originally designated "Atlanta" by Lockheed, the Royal Air Force named their aircraft "Lightning," and the Army Air Corps liked the British name so much that Lightning was adopted. The planes had a reputation as being difficult to handle and deadly if you lost an engine on take-off. But the aircraft's quick turning radius and its ability to climb eventually allowed the plane to gain pilot acceptance.

During the North African campaign the German Luftwaffe dubbed it "Der Gabelschwanz Teufel" – "The Forked-Tailed Devil." Equipped with counter rotating propellers, consolidated firepower, twin engine safety, and superior range, the Lightning was in a class by itself. Since the armament of the aircraft was concentrated in the central fuselage pod, the guns were fired parallel with no propeller synchronization needed. A one-second burst from its guns could bring down an enemy plane. This same firepower proved exceptional for strafing ground targets at low altitude. This would prove very valuable during the North Africa campaign where the inexperienced U.S. pilots got their first taste of combat action.

The plane saw action in virtually every major combat arena of the world. A very adaptable aircraft, the Lightning was also used for dive bombing, level bombing, ground strafing, and photo reconnaissance missions. By the end of production in 1945, over 9,000 P–38s had been built.



P-51 D Series Specifications:

Wing Span:	37 ft. 5 in.
Length:	32 ft. 3 in.
Height:	13 ft. 8 in.
Weight	
Empty:	7,125 lb.
Loaded:	11,600 lb.

Performance:

Maximum Speed:	437 mph.
Range:	1,650 miles (with tanks)
Service Ceiling:	41,900 ft.

Armament:

Six – .50–cal. Browning machine–guns in wings
Bomb Load – 2,000 lbs.
Ten – 5-in. rockets

Power Plant: One – 1,590 hp 12–cylinder Packard V–1650 "Merlin" inline engine – licensed from Rolls–Royce

Fuel Capacity: 1,614 lbs.

Accommodation: One

North American P-51 Mustang

The British knew by late 1938 that war with Germany was inevitable. They also realized that their production capabilities could not supply enough aircraft to the Royal Air Force to meet its upcoming role. So a contingent from the Air Ministry was dispatched to investigate aircraft companies in the U.S. who could supply new military aircraft. The tour resulted in orders being placed with Lockheed for reconnaissance bombers and North American for flight trainers. After the war started in 1939, the Air Ministry quickly found themselves back in America looking for more aircraft. But this time their situation was compounded by the steady attrition of their military aircraft in combat.

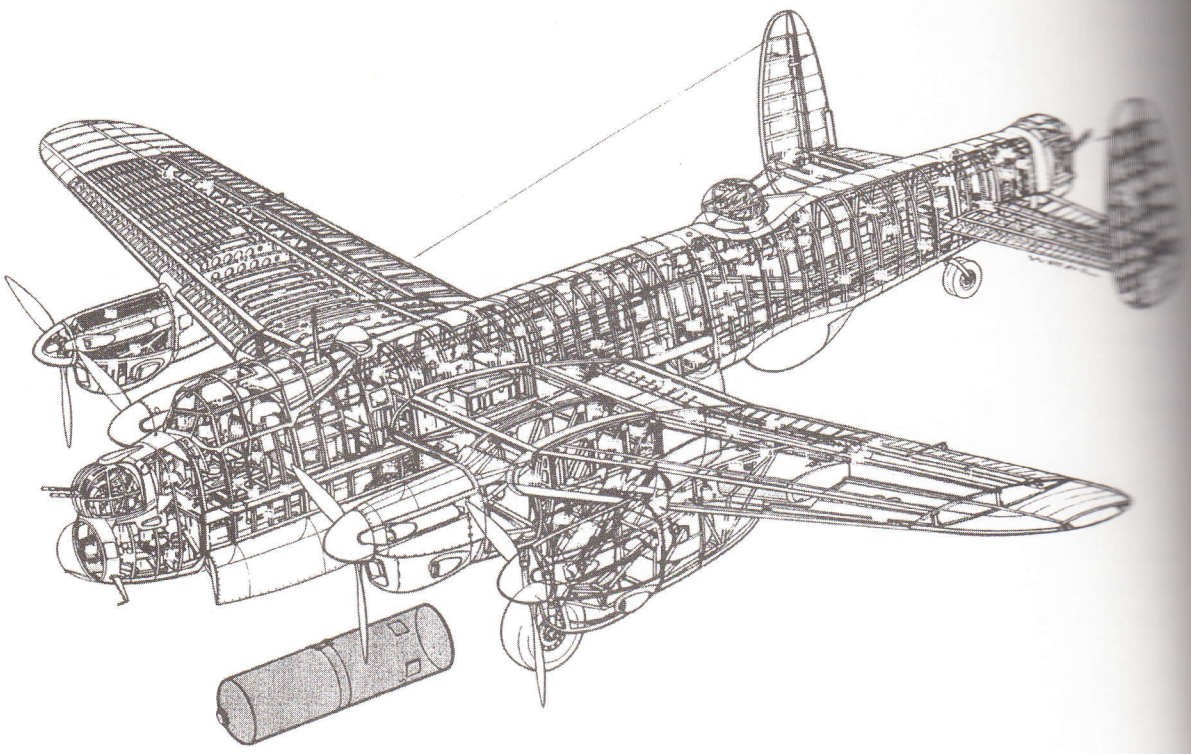
Based on their satisfaction with North American, that company was given a contract to design a new fighter. Provisions of the contract required North American to deliver the new fighter for flight testing in 120 days. Chief designer Edgar Schmued, a German engineer who had migrated from Bavaria in 1930, set about creating an aircraft that maximized performance by utilizing a laminar flow wing. Originally developed by the National Advisory Committee for Aeronautics (NACA), this airfoil greatly improved the aircraft's performance and range capabilities through increased fuel efficiency. In addition to the unique airfoil design, the NA-73's streamlined airframe further reduced drag and created a smooth air flow. On October 26, 1940, North American delivered the prototype, the NA–73, 117 days after design sketches had been submitted to the British for approval.

The initial tests quickly showed that a major breakthrough in fighter design and performance had been achieved. On its fifth test flight, pilot error resulted in the plane running out of fuel and flipping over in a field. The airframe sustained major structural damage, but the British government was convinced of the plane's prospects and ordered over 600 aircraft. At the same time, the U.S. government requested two aircraft for evaluation. They designated these planes, the XP-51, "Apache," while the British dubbed their planes the "Mustang."

The first production aircraft arrived in Liverpool, England in October 1941, in a large wooden crate. Initial trials demonstrated the one drawback of the aircraft using the Allison V-1710 engine. Its power greatly fell away at higher altitude and made the plane difficult to control. This greatly limited high-altitude performance caused the British to limit the plane's role to photo recon and ground support. During this period, modifications were made to several of the test aircraft. One modification in particular would have such a far-reaching effect that it would impact Allied air superiority and eventually the outcome of the war in Europe. This was the modification to use the British Rolls Royce "Merlin" engine that greatly enhanced speed and service ceiling.

In addition to the engine modification, several other developments helped to create a superior fighter. The bubble canopy was adopted from the Hawker Typhoon to provide an unobstructed rear view. A gyroscopic gunsight (K-14) was developed that allowed greater accuracy in deflection shots during high speed dogfights. Special pilot G-suits helped to prevent blackouts. All of these developments helped to give the P-51 a distinct advantage in combat.

In 1943, the Merlin Mustang first entered combat over Europe. This much needed high-altitude escort for the B-17s and B-24s greatly diminished bomber losses and sounded the death knell for the German air force. The Mustangs scored heavily on the German interceptors. By war's end, P51s had destroyed 4,950 enemy aircraft in the air, more than any other fighter in Europe. Between 1941 and 1945, the Army Air Corps ordered nearly 15,000 Mustangs.



Lancaster Mk I Specifications:

Wing Span:	102 ft.
Length:	69 ft. 4 in.
Height:	19 ft. 7 in.
Weight	
Empty:	41,000 lb.
Loaded:	72,000 lb .

Performance:

Maximum Speed:	281 mph.
Range:	2,680 miles
Service Ceiling:	24,500 ft.

Armament: Two – 7.7 mm Browning guns in each nose, dorsal & ventral turrets, four – 7.7 mm Browning guns in tail turret
Bomb Load – 14,000 lb.

Power Plant: Four – 1,460 hp 12–cylinder Rolls–Royce Merlin XX inline engines

Fuel Capacity: 15, 522 lbs.

Accommodation: Seven – Pilot, flight engineer, navigator, bomb aimer, wireless–operator, mid–upper and rear gunners.

UNITED KINGDOM

Avro Lancaster

During the pre-war years, there were international campaigns to "ban the bomber." The technological advances made in aviation could now bring war directly to the homes of civilian populations in a way that only invasion could have done in the past. Yet during this time, the British Air Ministry had no reservations about bombers; in fact, they had laid in a course for a major build-up of the RAF. A major part of the expansion was for heavy bombers. This was due in part to the success of the B-17. The new techniques employed in that aircraft showed that modern offensive bombers could combine speed, altitude, and range. The Air Ministry set about creating a new class of bombers superior to the B-17.

The specifications for the new "heavies" called for high performance and a large bomb load. Since Germany was regarded as a likely enemy, the new bombers were required to have a range of at least 2,000 miles. These new bombers, like the B-17, were expected to defend themselves, so powered gun turrets were incorporated into the specifications. From the specifications emerged three new bombers: the Stirling, Halifax, and Manchester.

The Manchester bomber was a complete disaster from leaking hydraulics, directional instability, and two totally unreliable Rolls Royce Vulture engines. Just as the second squadron became operational, bearing failures and fires in the engines grounded the entire bomber force. The ultimate solution to this problem came from an agreement between Rolls Royce and Packard in the U.S. Packard was licensed for the production of the Merlin engine that had been in short supply. Once this engine became available, production modifications were made, and the Manchester II debuted on January 9, 1941, powered by four Rolls Royce "Merlin" engines. Due to the Manchester's miserable reputation, it was decided to give the aircraft a new name. It was renamed the Lancaster.

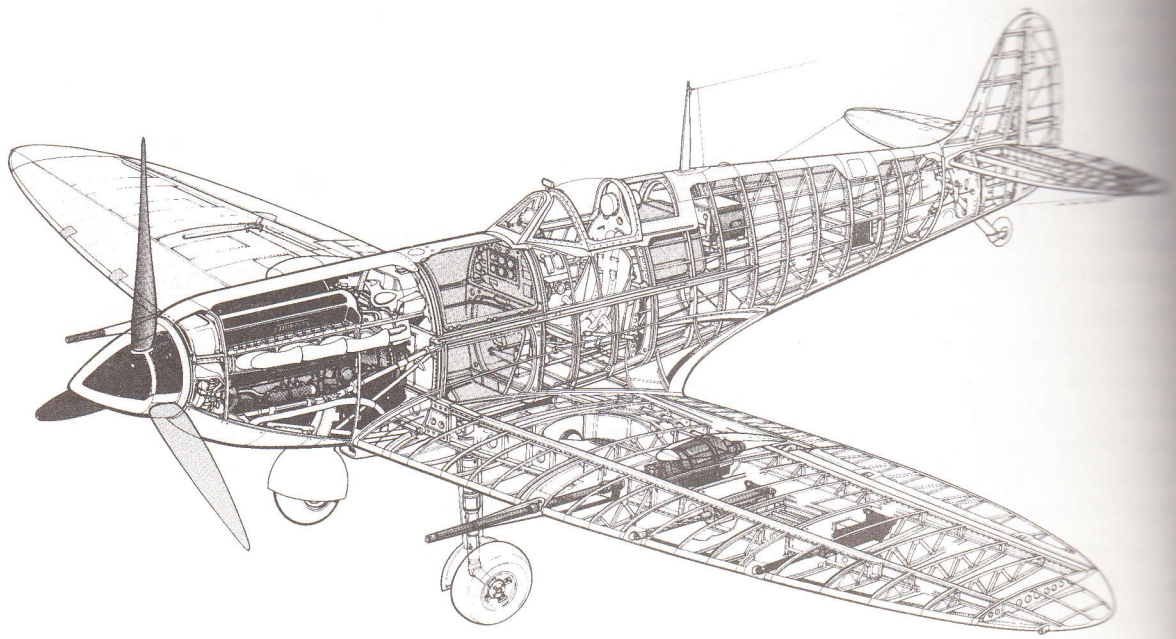
This new combination of modified airframe and additional power plants gave Bomber Command the aircraft they needed to take the war deep into enemy territory. The "Lanc" differed from the Stirling and Halifax in that it carried all of its bombs in the fuselage. The large, uninterrupted bomb-bay was the heart of the design and the reason why the Lancaster could carry a bigger bomb load than any other wartime aircraft

During the coarse of the war, the plane continually delivered higher and higher payloads to enemy targets. Starting with an 8,000–pound bomb dropped in 1942 and concluding with the 22,000–pound Grand Slam dropped in March 1945, the Lancaster delivered a total of 608,612 tons of bombs during the war.

The aircraft had few vices and could easily be put into the "corkscrew" evasive maneuver practiced by Bomber Command. The corkscrew was a sequence of wingover, maximum-rate descent, and climbing turn where horizontal and vertical airspeed and attitude varied widely to the maximum values. One major shortcoming of the Lancaster's defenses was no bottom turret. This "blind spot" would later be greatly exploited by the Luftwaffe.

But the new plane faced an even greater challenge in its role as a strategic bomber. It was determined that the aircraft could not properly defend itself during daylight attacks as evidenced by an unescorted daylight raid by 12 Lancasters on a German factory that resulted in the loss of all but one aircraft. To further complicate matters, the bombers were unable to locate their targets at night. To improve this situation, Bomber Command formed special Pathfinder squadrons assigned with marking the targets with flares. The Pathfinders used an ever-increasing array of technological advancements to find their way to the targets. The first was called Gee, which was a radio navigation device. Next came Oboe, a highly accurate marking aid, and finally an unlimited range ground mapping radar called H2S. Along with these navigation aids, new counter-measures were developed that included radio jammers, radar warning, and radar jamming devices.

The Lancaster was immortalized in the film *Dam Busters*. The movie portrayed Bomber Command's heroic effort at crippling German industrial production. The 617th Squadron flying sixty feet above the water used the Barnes Wallis Bouncing Bomb to breach the Mohne, Eder, and Sorpe dams, flooding the Ruhr industrial area. More than 7,000 Lancasters were built during the war. The reliable "Lanc" remained in front–line service with the RAF until 1954, and a direct descendent of the design would be in service until 1982.



Supermarine Spitfire Mk VB
Specifications:

Span:	36 ft. 10 in.
Length:	29 ft. 11 in.
Height:	11 ft. 5 in.
Weight	
Empty:	5,065 lb.
Loaded:	6,650 lb.

Performance:

Maximum Speed:	367 mph
Range:	1,135 miles
Service Ceiling:	36,000 ft.

Armament:
Four – Browning .303 calibre machine guns
Two – 20 mm Hispano cannons
One – 500 lb. bomb or two 250 lb. bombs

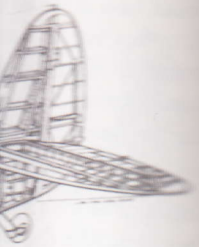
Power Plant: One – 1,440 hp 12–cylinder Rolls–Royce Merlin inline engines

Fuel Capacity: 840 lbs.

Accommodation: One

Supermarine Spitfire

The aircraft of the second world war epitomizes a fighting spirit better than the Spitfire. An underdog from the start, this scrappy fighter became a symbol of tenacity and courage for a beleaguered nation standing alone against a mighty fighting force.



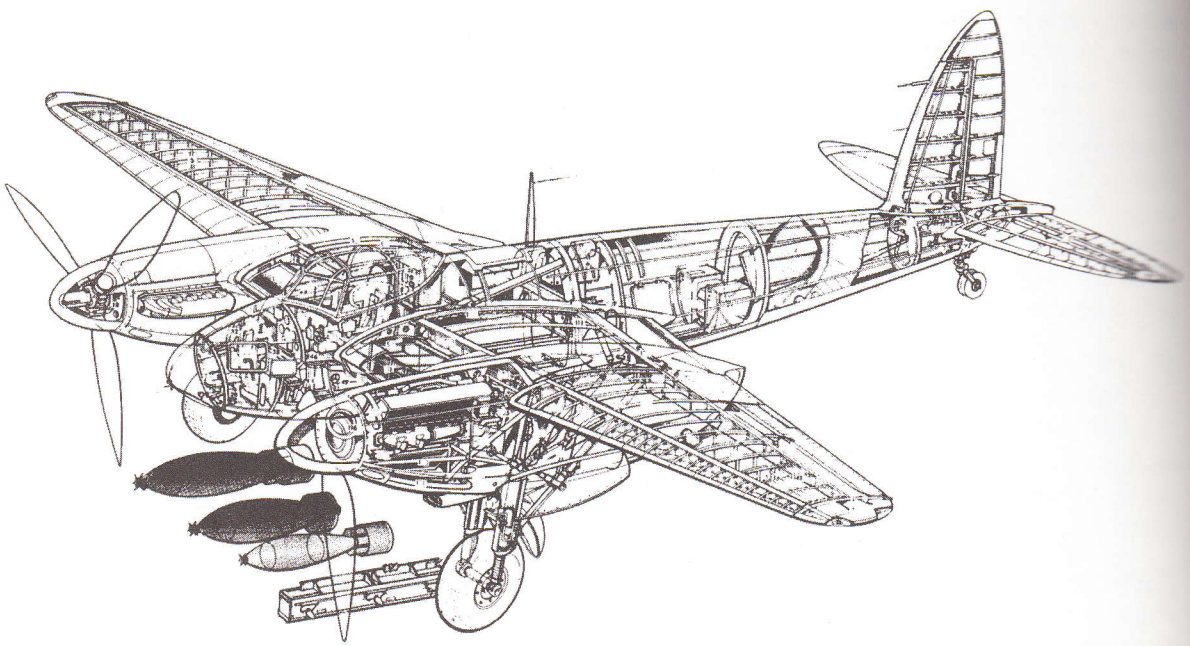
A descendent from Reginald Mitchell's great seaplane racers of the 1920s, the Spitfire's proud lineage would help to assure its place in aviation history. In 1931, the Air Ministry in London issued Specification F7/30 for a fighter to replace the RAF's aging Bristol Bulldog. Five biplanes and three monoplanes entered the contest, but the performance of Supermarine's entry, Type 224, was abysmal, reaching a top speed of only 238 MPH and taking eight minutes to reach 15, 000 feet. The RAF choose a radial engine biplane that had easily out-performed Supermarine's entry in every aspect. Despite the disappointment, Supermarine continued fighter development with the Type 300 that was based on the failed Type 224. The 300 had a closed cockpit, retractable landing gear, and a thinner shape. These refinements were unable to improve performance. In 1934 Rolls Royce delivered the twenty-seven liter, 1,000 HP, PV XII, (later named Merlin) powerplant to Supermarine, and combat fighter performance would be changed forever. This would prove to be another great combination of airframe and powerplant technology that would help shape the course of history.

Mitchell had redesigned several components of the Type 300 to deal with the heavier engine, undercarriage, and guns. However, the change made in the wing design created a "washout" that allowed the root to stall before the tip. This feature allowed the aircraft to maintain tight turns without stalling. This element would prove critical in the battles soon to be raging in the skies over England. To improve performance, the aircraft carried only 75 gallons of fuel. By March of 1937, the prototype (Serial No K5054) was ready for flight testing. The aircraft proved reliable from the start, and the Air Ministry ordered it into production and named it "Spitfire."

Three days after the war started, the Spitfires saw action for the first time. 74th Squadron scrambled and attacked what they thought were enemy fighters over the Thames estuary. The fighters downed two aircraft, while anti-aircraft fire claimed another. As it turned out the RAF had shot down its own planes. This tragic incident paved the way for the implementation of FOE equipment (Identification Friend or Foe) for all RAF aircraft. On October 16, 1939, the Spitfires engaged the real enemy when nine Junkers 88s appeared over the Firth of Forth searching for Royal Navy ships. Two of the bombers were shot down, and the raid failed to achieve its mission.

It was not until 1940 that confrontations between the Spitfire and the Messerschmitt 109 took place. These early skirmishes were but a prelude for the main event about to unfold over England from July to October. The German plan was to destroy the RAF's ability to defend British airspace, clearing the way for an invasion. To accomplish this, the Luftwaffe intended to destroy the RAF airfields. This required sending fighter escorts with the bombers. The 109 had one slight advantage over the Spitfire. Its fuel-injected Daimler-Benz engine gave its pilot the ability to get away from a pursuing Spitfire. The Merlin's conventional carburetor could not handle negative G maneuvers, and the engine would cut out if negative G was applied. A 109 could be pushed over under power into a dive. If the Spitfire were to follow, it had to maintain positive G by being rolled on its back and pulled through. Between July and October, the RAF squadrons destroyed 1,887 aircraft, of which 873 were fighters. The Spitfire accounted for almost thirty percent of the victories.

The Spitfire saw action in North Africa, Italy, and France. The Spitfire also was responsible for shooting down many of the V1 Flying Bombs in 1944 and was the first RAF aircraft to shoot down a Me-262 jet fighter. The aircraft continued in service in various forms and saw action in Korea in 1950. The RAF still operates several Merlin Spitfires as a reminder of the major role this fighter played in combat history.



"Mosquito" FB VI Specifications:

Span:	54 ft. 2 in.
Length:	41 ft. 2 in.
Height:	15 ft. 3 in.
Weight	
Empty:	15,970 lb.
Loaded	23,000 lb.

Performance:

Maximum Speed:	358 mph
Range:	1,855 miles
Service Ceiling:	33,000 ft.

Armament:

Four – 20–mm Hispano cannon in front fuselage
Four – 7.7 mm Browning guns in the nose
Bomb Load – 2,000 lb.
Eight – 60 lb. rockets

Power Plant: Two – 1,635 hp 12–cylinder Rolls–Royce Merlin XX1 inline engines

Fuel Capacity: 3,862 lbs.

Accommodation: One

DeHavilland Mosquito

The DeHavilland company had a keen interest in air racing. This interest resulted in the design of an incredibly fast and sleek aircraft for the London to Melbourne air race in 1934. Constructed primarily of plywood, the D.H. 88 Comet won the race and set the stage for the design of the Mosquito.

As the clouds of war gathered over Europe in the late 1930s and the DeHavilland company became more involved in military development, a design emerged for an unarmed wooden bomber. At first the idea was rejected, but after it was shown that a twin engine powered bomber could outrun a Spitfire, the design was given the go-ahead.

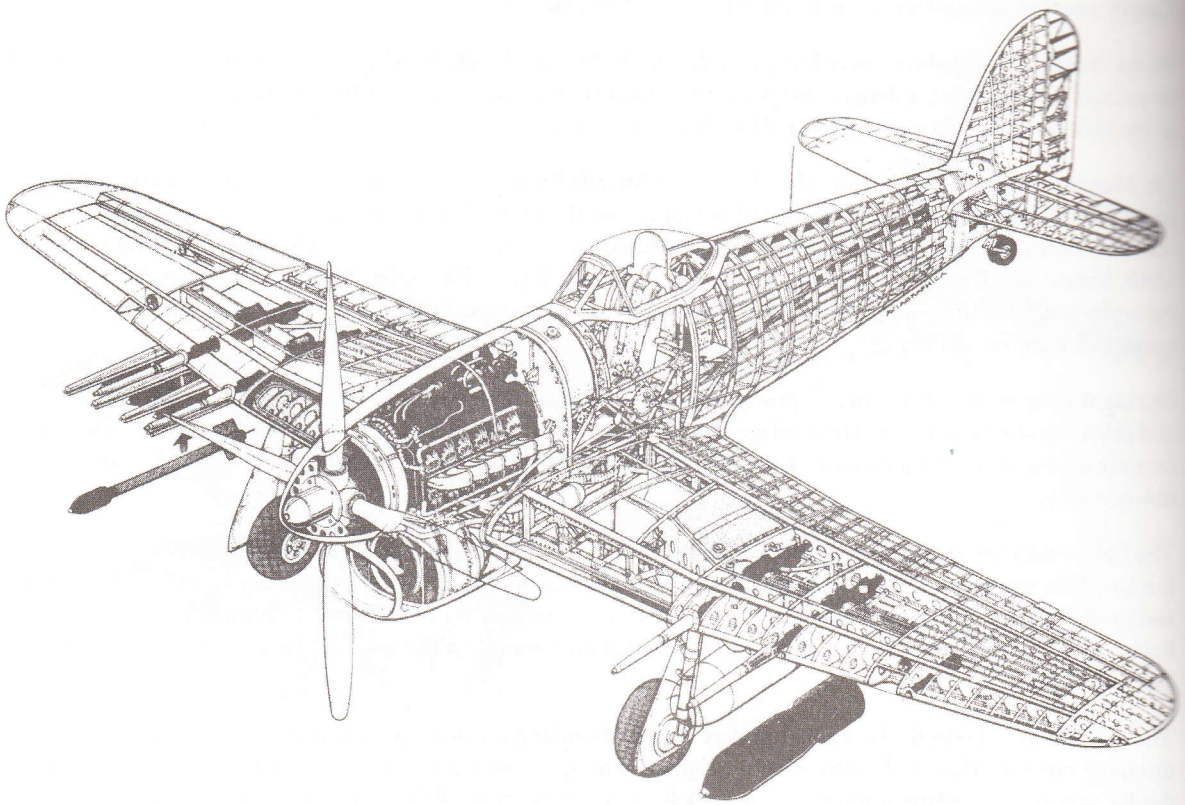
On March 1, 1940 a contract from the Ministry of Aircraft Production was placed for fifty of the wooden bombers based on DeHavilland's design. But the fall of France and the Dunkirk disaster caused the cancellation of the contract. Fortunately, the Ministry reversed their decision and production resumed. During the difficult months of 1940, bombs fell all around the DeHavilland aircraft factory. But on November 25, 1940, just ten months after being designed, Geoffrey de Havilland successfully flew the prototype. From the start this aircraft had both great speed and maneuverability.

During the war its wooden structure provided work for British companies that had once made furniture, pianos, and other wood related items. The fuselage was made in a left and right half. After all of the components were fitted into the halves, they were joined like a plastic model. Above all, the plane's wooden structure avoided using scarce new materials.

The fighter-bomber version was developed for sweeps that continually harassed the Luftwaffe over occupied Europe. This version carried two 500 lb. bombs internally and two on the wing pylons, in addition to the cannon and machine guns. When British intelligence discovered a large number of concrete emplacements in Northern France, the "Mossies" were sent in to destroy the flying bomb sites. In a two month period, 600 V–1 "buzz" bombs were destroyed.

The Mossies served effectively as a pathfinders in night bombing missions, preceding the bomber streams by dropping target markers and outrunning the fighters sent up to intercept them. The wooden aircraft were also quite deadly, racking up the largest number of night kills for the RAF. Night fighters destroyed 600 enemy aircraft over Britain in a three year period. The aircraft successfully attacked U-Boats in the North Atlantic with a 57mm anti-tank gun mounted in the nose. The fighter-bomber version was the first twin-engine aircraft to land on the deck of an aircraft carrier. The Royal Navy later modified the plane into a folding wing sea version that never saw combat action.

In addition to its combat role, the aircraft also served as an airliner for BOAC on its important route to Sweden. The Mosquito entered production in mid–1941, and production continued until well after the end of the war. The bomber served with the RAF until 1963. Almost 8,000 Mossies were built in Great Britain, Canada, and Australia. The bomber was the fastest RAF aircraft in service until the introduction of the twin–jet Canberras in 1951.



Hawker Typhoon Mk I Specifications:

Span:	41 ft. 7 in.
Length:	31 ft. 11 in.
Height:	15 ft.
Weight	
Empty:	9,250 lb.
Loaded:	13,500 lb.

Performance:

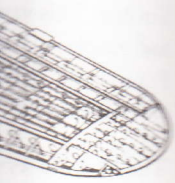
Maximum Speed:	412 mph
Range:	510 miles
Service Ceiling:	35,200 ft.

Armament:
Four – 20 mm Hispano cannons
Bomb load – 2,000 lb.
Eight – 60 lb. rockets

Power Plant: One – 2,180 hp 24–cylinder flat–H Napier "Sabre" II inline engine.

Fuel Capacity: 1,080 lbs.

Accommodation: One



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Hawker Typhoon

The "Tiffy" was a direct descendent of the legendary Hawker Hurricane. The plane was originally designed by Sydney Camm at Hawker Aircraft to be a high–altitude dogfighter. He set out to harness the untried potential of two new 2,000+hp aircraft engines, the Napier Sabre and the Rolls Royce Vulture. The Vulture engine version (Tornado) proved to be totally unreliable and was cancelled.

The Sabre-powered aircraft was hastily rushed into production, and the first deliveries were made by late 1941. The initial production aircraft had a range of problems that included the tail falling off in dives and engines that refused to start in cold weather. After numerous engine revisions, airframe modifications, and armament changes, the Typhoon finally matured into a potent fighter. However, poor performance at higher altitude relegated the Typhoon to a role as a low–level interceptor and ground attack plane. Yet it was in the latter role that the aircraft would truly come in to its own as a great ground-attack aircraft.

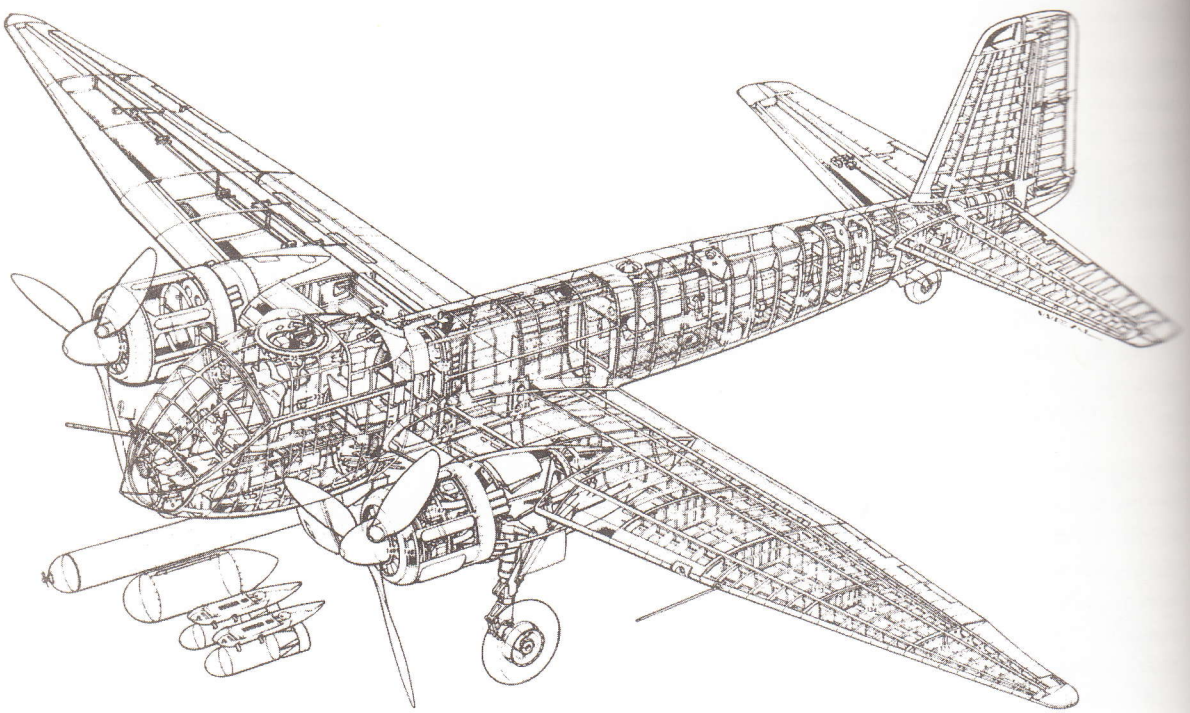
Typhoons usually operated during periods of heightened air activity over enemy occupied territory—usually in conjunction with a Fortress raid and various diversionary sweeps. Loaded with bombs, the Typhoon squadron leader would begin the attack by peeling off toward the target at 60 degrees. Each squadron member followed the leader in a plunge that reached 470 m.p.h. After the bombs were released, the aircraft pulled out of the dive and headed back to base. Usually another Typhoon squadron would fly top cover during these attacks.

During periods of poor weather, the squadrons were released to attack targets of opportunity. Single aircraft would fly low looking for trains, trucks, or factories. Armed with four 20 mm cannons, eight rockets or 2,000 lb. of bombs, its ability to take out bridges, buildings, railroads, or Panzar divisions became legendary. The plane distinguished itself in the Battle of Normandy where it destroyed no fewer than 173 tanks. The "Bombphoons" were incredibly accurate as dive bombers and were used extensively in "Ranger" operations that directly affected the outcome of many land battles. The usual drill in an attack was to keep the gunners' heads down, then to jink the aircraft, distorting its line of flight, and kick the Typhoon steady at the last moment, holding the bead on the target and firing the rockets. Experienced pilots did this without having to think about controlling the aircraft.

In August 1944, Typhoons were pitted against German tanks in a day-long battle at Mortain, France. German Panzar units were attempting to drive a wedge between advancing British and U.S. forces. This massive armor attack allowed the Typhoons the opportunity to rocket Panzar armor out in the open. A Panzar division did not consist solely of tanks, but included armored vehicles, trucks, infantry, and all the equipment necessary to make up a mobile army; it would fight a ruthless battle. The Panzars were familiar with rocket attack and would open up with every weapon they had when they saw the little puffs of smoke emerge from under the planes' wings.

The rockets were cordite-burning missiles, and when launched they required 2,200 yards to reach maximum velocity so that their armor-piercing heads could penetrate a tank. This distance—a mile-and-a-quarter—at speeds of 400-450 m.p.h. in a steep dive, was difficult to gauge, especially when flying through a wall of flak. As the morning mist burned off on that August morning, the recon Typhoons had returned with news of the impending German attack. The intelligence briefing sent aircraft up in pairs to attack the Panzars who were less than fifteen minutes away. After firing all their rockets, the aircraft were to return to base for re-fueling and re-arming. This continual cycle of attacking Typhoons was to continue until 139 tanks were destroyed or damaged.

The plane was the first aircraft in the war to be fitted with a sliding bubble canopy, offering the pilots a better look aft. This bubble style was soon adopted by the USAAF in the P–51s. Production of the Typhoon, which was entirely the responsibility of Gloucester Aircraft, totalled over 3,000 aircraft.



Ju-88A4 Specifications:

Wing Span:	65 ft. 10 in.
Length:	47 ft. 1 in.
Height:	15 ft. 11 in.
Weight	
Empty:	17,637 lb.
Loaded:	30,863 lb.

Performance:

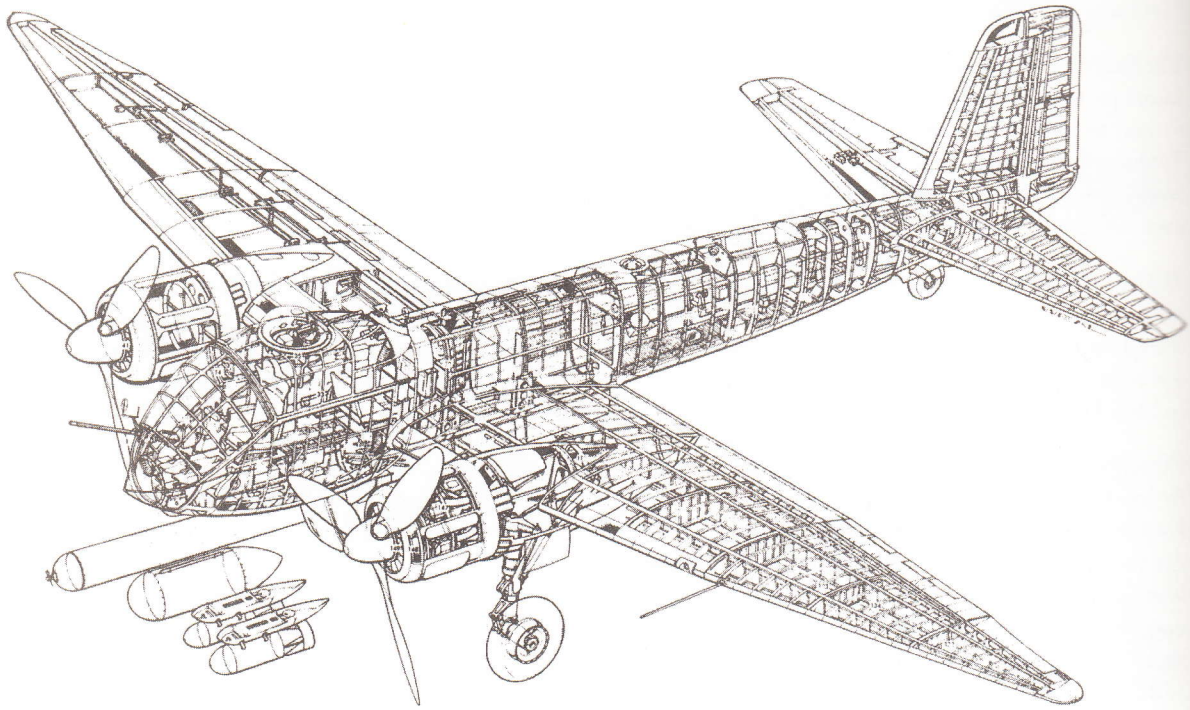
Maximum Speed:	295 mph.
Range:	1,552 miles.
Service Ceiling:	26,900 ft.

Armament:
Four – 7.9 mm machine guns (rearward)
Two – 13 mm machine guns (forward)
Bomb Load – 3,305 lb.

Power Plant: Two – 1,400 hp 12–cylinder Junkers Jumo 211J inline engines

Fuel Capacity: 4,134 lbs.

Accommodation: Four – Pilot, Co–Pilot, Engineer, Radio Operator



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Junkers Ju 88

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GERMANY

Junkers Ju 88

The German Ju 88 was one of the most versatile airplanes of WW II. Originally converted from a civilian airliner, it was used in practically every kind of combat role. These roles included dive bomber, level bomber, night fighter, day interceptor, photo reconnaissance, tank destroyer, and even as a "pilotless missile."

The RLM (German air ministry) issued specifications in 1935 for a Schnellbomber (fast bomber) to Germany's aviation industry. Junkers set out to win the contract. To improve the company's chances of winning the contract, two designers were hired who had worked in the U.S. pioneering advanced stressed-skin structures. Even though Junkers had already moved away from corrugated skin and produced numerous smooth-skinned prototypes, they wanted to have the best design team for the project. The prototype crashed at the start of its high-speed trials but not before it demonstrated sound design characteristics and promising performance. A subsequent prototype set a world speed record of 321 mph in March 1939. The secrecy wraps were taken off the aircraft, and praise was bestowed upon chief designer Ernst Zindel; the Americans were not mentioned.

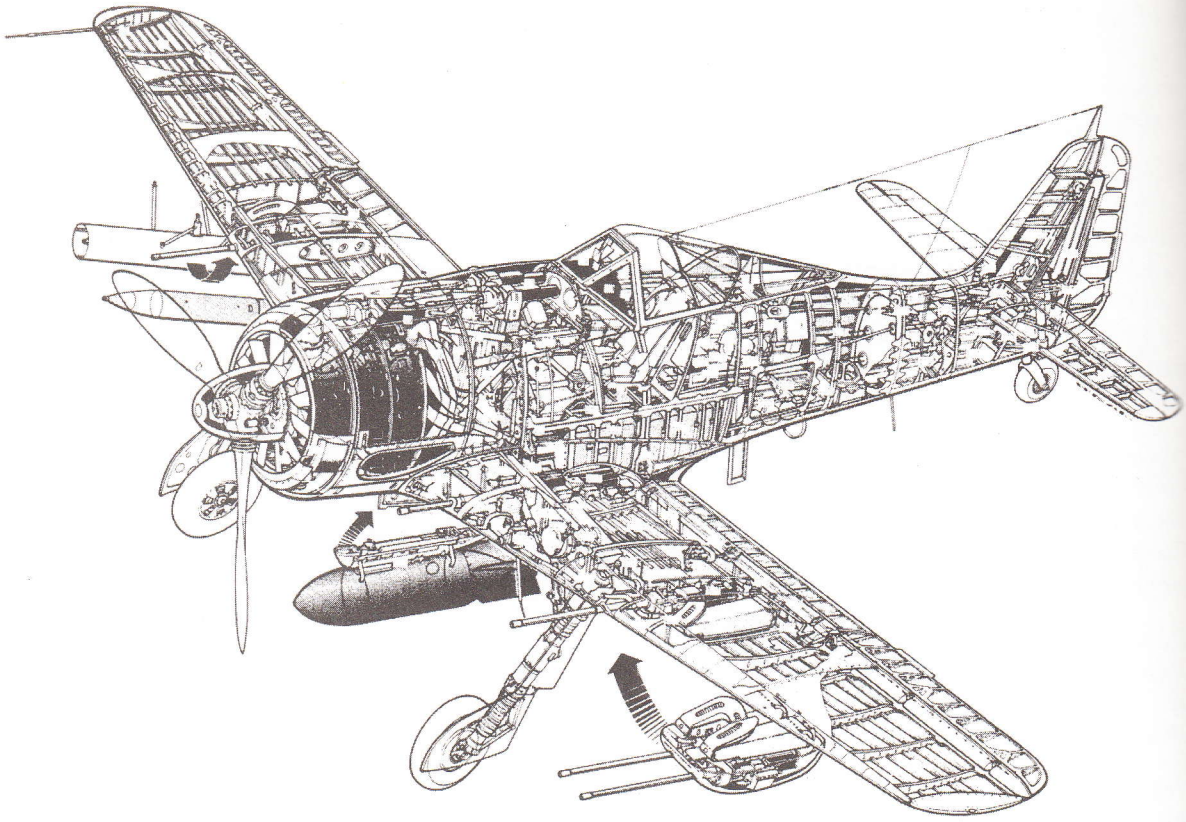
Production of the Ju88 was shared by a number of widely separated sub-contractors including Arado, Dornier, Heinkel, Henschel, and Volkswagen. As the aircraft was developed and production got underway, several problems developed that included wing-spar failure, main-leg failure, and other faults that were attributed to overloading. Crews were cautioned to follow the factory prescribed weight and balance diagrams exactly to avoid accidents. The problems were corrected, but aerobatics with the aircraft were prohibited.

During dive bombing attacks, the pilot did the bomb-aiming, which was usually done from an angle of sixty degrees. During level bombing the bomb-aimer performed the task while using a sight in the nose. He also doubled as a second pilot. The flight engineer, who sat behind the pilot, manned the upper rear guns. On his right was the radio/radar operator, who looked after the lower rear gun.

The Ju88 first saw combat in September 1939 against British naval forces in the North Sea. By the start of the Battle of Britain, the Ju88 squadrons were now operating at full strength. The Ju88s saw considerable success against RAF airfields, but the RAF had extracted a heavy loss rate on the bombers, primarily due to insufficient armament and armor protection.

By early 1941, enough quantities of the Jumo 211 engines had become available to allow Junkers to begin production of the Ju88A-4. The increased power allowed for increased armor protection, bomb load, and fuel. The top speed was increased by 15 mph, and this variant would be the basis for most models that followed. Nearly half of all operational Ju88s were set for the invasion of Russia in June of 1941.

The great range of this plane would make long night patrols over England and North Africa possible. Later modified into a fighter–bomber, the Ju 88's performance and armament allowed it to fare better than its fellow Dorniers and Heinkels. Its armament included a set of cannons that could fire upward at an angle of 60 degrees. Radar equipped planes carried short–range Lichtenstein radar to detect Allied bombers at night. The Ju 88s were used as night–fighters and were responsible for downing the largest number of RAF bombers. This was accomplished by homing in on the RAF's tail–warning radar signal. The night–fighters followed the radar signal to attack the totally unprotected underbelly of the Lancaster. New designs after 1943 increased the Ju 88's top speed to over 400 mph. During its service, from 1939 to 1945, over 10,000 were produced in ten variants with 104 prototypes.



Fw190A Specifications:

Wing Span:	34 ft. 5 in.
Length:	29 ft.
Height:	13 ft. 7 in.
Weight	
Empty:	7,055 lb.
Loaded:	10,800 lb.

Performance:

Maximum Speed:	408 mph.
Range:	470 miles on internal tanks.
Service Ceiling:	37,400 ft.

Armament:
Two – 13 mm cannon, four – 20 mm cannon
Bomb Load – 1100 lb.
Twenty-four – R4M underwing rockets

Power Plant: One – 1,700 hp 18–cylinder BMW 801D radial engine

Fuel Capacity: 1,020 lbs.

Accommodation: One

Focke-Wulf Fw 190

In the fall of 1937, the Reichluftministerium (German Air Ministry) placed an order with Focke–Wulf Flugzeugbau for the design and development of a new fighter plane to supplement the Messerschmitt Bf109. The design team headed by Dr. Kurt Tank, chief designer of Focke–Wulf Flugzeugbau, proposed a radial engine fighter. Since the liquid-cooled engines were in short supply, a radial engine fighter would put no demands on the delivery schedule of the Bf109 engine.

Designated Fw 190 V1 and carrying the code letters D-OPZE, the aircraft was flown on June 1, 1939. After five test flights the plane was turned over to the Luftwaffe for trials. The tests showed a responsive fighter with a tight turning radius that offered rapid acceleration in both climb and low level modes of operation. Numerous problems plagued the prototype, including excess cockpit heat and engine cowlings flying off at high speeds. The test program showed that constant engine overheating was a major problem that resulted in many aircraft unable to take-off or returning to base shortly after take-off with black smoke trailing behind them.

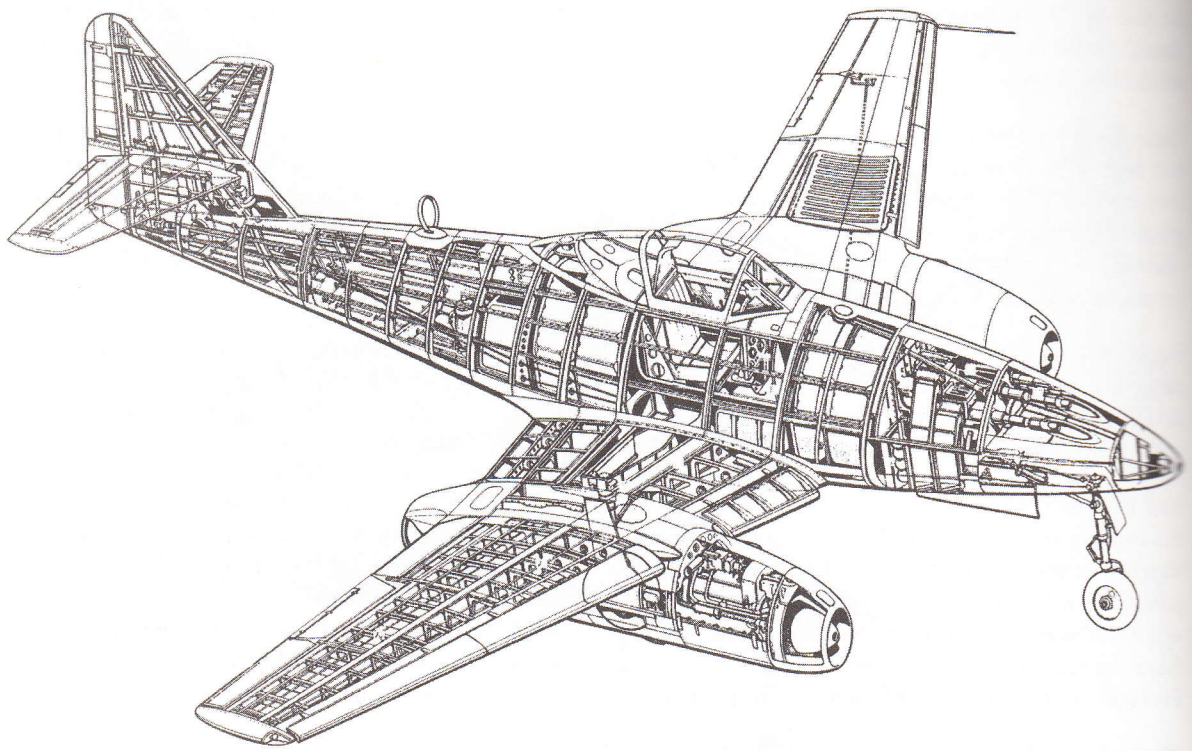
Focke-Wulf laid the blame on BMW, while BMW blamed Focke-Wulf for the problems. RLM was considering cancelling the entire project due to the seriousness of the problems being encountered. RLM gave Focke-Wulf and BMW one last opportunity to resolve the problems. After over 50 modifications in the design of the cooling fan, oil and cooling lines, and the oil cooling ring, the RLM accepted the Fe 190 for service.

The Fw 190 ("Würger," or Butcher Bird) joined the Luftwaffe in mid–1941, where it surprised the Spitfires over the beaches at Dunkirk. The Fw 190s dove on the Spitfires and destroyed three while escaping without a loss. So superior in speed, climb, and handling was the Fw 190 that Luftwaffe pilots were able to engage and break off combat at will. The Fw 190 combined superior handling, better firepower, and faster roll rates. The Fw190s were again put to the test during the channel dash of the German warships Scharnhorst, Prinz Eugen, and Gneisenau from the French port at Brest to anchorages in Keil and Wilhelmshaven, Germany in February 1942. A squadron of Fw190s and Bf109s provided top cover from just after daylight until late in the day.

While the Fw 190 had proved its worth by 1942, it still had a serious drawback. This was the aircraft's lack of performance at altitude above 20,000 ft. In its interceptor role the aircraft was expected to vector to and engage high altitude Allied bomber formations. Various power boosts were tried using nitrous-oxide injection that allowed short performance boosts. The power problem was not solved successfully until the introduction of the in-line engine at the end of the war.

The Fw 190 was used to attack the bomber streams attacking Germany in 1943. Fitted with rockets, they attacked the close bomber formations with devastating success. The tactic was to attack the bomber stream head-on with a group of rocket-firing 190s and then to attack the scattering individual bombers with standard equipped 190s.

Over the course of the war, the plane was modified to perform a number of combat roles that included fighter–bomber in the F and G versions. Further development and refining of the Fw 190 continued with the addition of the new Junkers Jumo 213 power plant. This made the aircraft the fastest operational fighter in the Luftwaffe (463 mph). This high altitude fighter provided protection for the Me 262 units during take-off and landing. Most units by the end of the war were used for home defense. By this stage of the war, poor training, lack of fuel, and Allied numerical superiority had reduced the plane's effectiveness in battle. By the end of the war, more than twenty thousand Fw 190s had been built.



Messerschmitt Me 262 Specifications:

Span:	41 ft.
Length:	34 ft. 9 in.
Height:	12 ft. 6 in.
Weight	
Empty:	8,818 lb.
Loaded:	14,936 lb.

Performance:

Maximum Speed:	541 mph.
Range:	650 miles
Service Ceiling:	38,000 ft.

Armament:
Four – 30mm Rheinmetall–Borsig MK–108A–3 cannons
Bomb Load – 1,100 lb.
Twenty–four – R4/M underwing rockets

Power Plant: Two – Junkers Jumo 004 Turbojet Engines

Fuel Capacity: 4,068 lbs.

Accommodation: One

Messerschmitt Me 262

The revolutionary Me 262 was developed from a 1938 design by the Messerschmitt company. Code-named "Schwalbe" (Swallow), it would become the world's first operational turbojet aircraft and the fastest aircraft in the war. In 1941, due to delays in turbojet production, the company was forced to test the airframe using a piston engine mounted in the nose. First flown as a pure jet on July 18, 1942, it proved much faster than conventional airplanes.

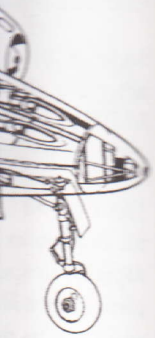
From the beginning, the new aircraft was plagued by development problems. These problems included long take-off rolls and unreliable engines that were prone to stalls and fires. The engines also had a total life of only 25 hours before needing replacement! But the Me 262 was a remarkably responsive aircraft, with harmonized controls and comfortable stick forces. A tendency to snake at high mach reduced the aircraft's usefulness as a stable gun platform. More serious was the fact that the single-engine safety speed was a high 180 mph. Engine failures below this speed inevitably ended in catastrophe, especially when the aircraft was heavy laden, and the accident rate was high. There was simply insufficient control power to hold the aircraft on an even keel with asymmetric power. The aircraft was relatively underpowered, and take-offs were long and difficult.

Hitler's insistence that the aircraft be used primarily as a fighter–bomber further complicated its development and deployment. A raid by the U.S. 8th Air Force on the Messerschmitt factory in August 1943 destroyed much of the new Me 262 production line, forcing Messerschmitt AG to move its jet development center to Oberammergau near the Bavarian Alps.

Finally, on July 25, 1944, the Me 262 became the first jet airplane to be used in combat. The jet attacked a British photo–reconnaissance Mosquito flying over Munich. Hitler's insistence on the Me 262 being the property of General der Kampfflieger denied General Galland the opportunity of forming the first fighter units until September 1944.

The jet continued to be used on bombing attacks on Allied front lines, reconnaissance missions, and on occasional forays against enemy fighters. As a fighter, the German jet scored heavily against Allied bomber formations. The bombers, however, destroyed hundreds of Me 262s on the ground. Of the nearly two thousand Me 262s produced, fewer than 300 saw combat. The majority were unable to fly because of lack of fuel, spare parts, or trained pilots.

After the war, the Allies thoroughly evaluated the captured Me 262s. Many of the jet's advanced features, including swept wings, leading edge slats, and flying tail were incorporated into the next generation of turbojet aircraft.



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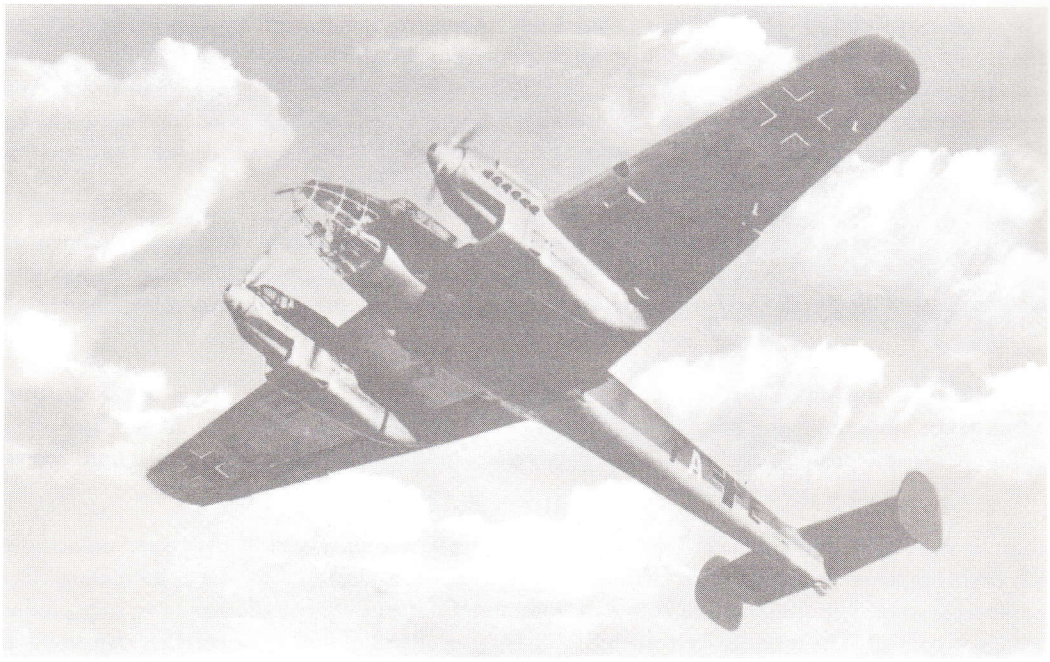
Turbojet



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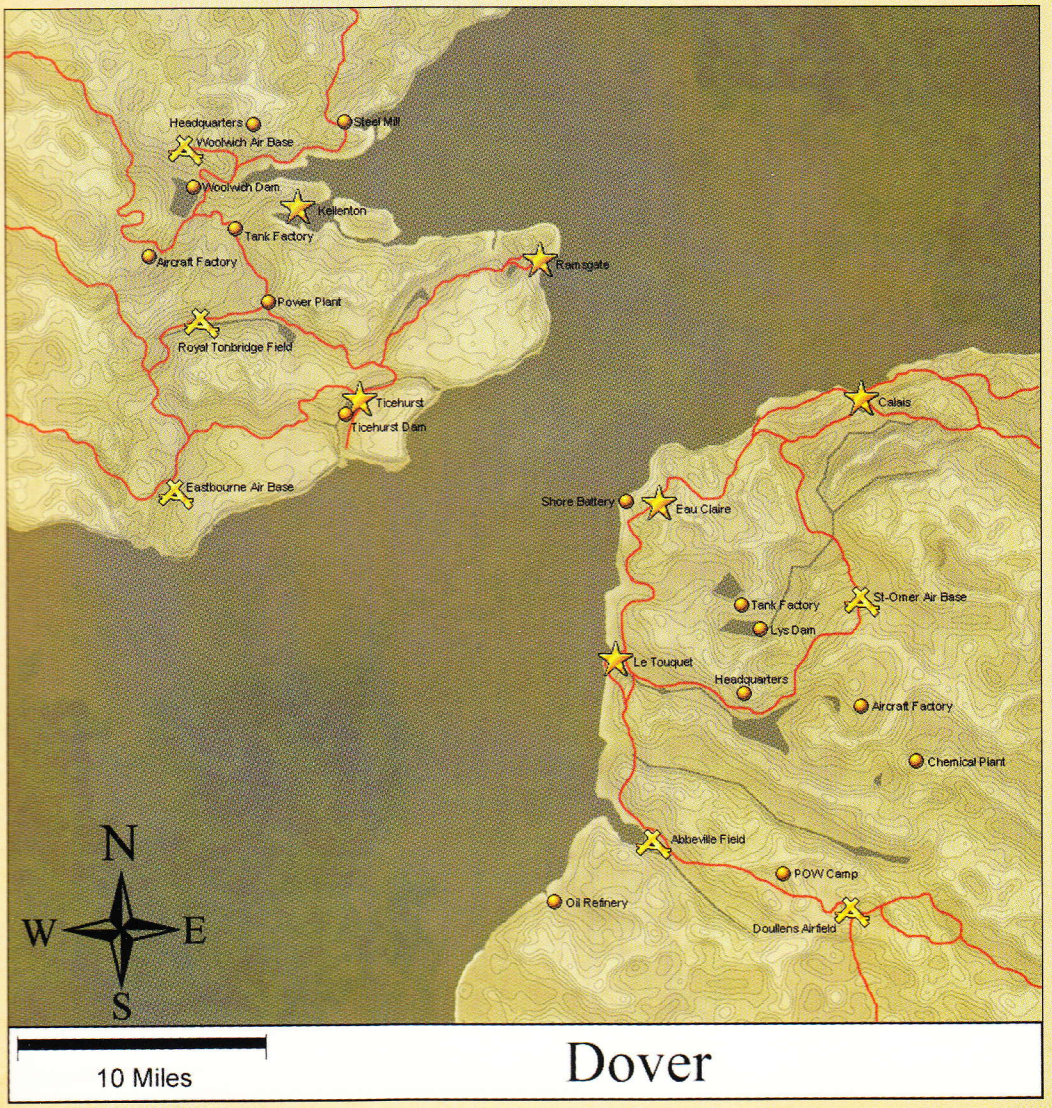
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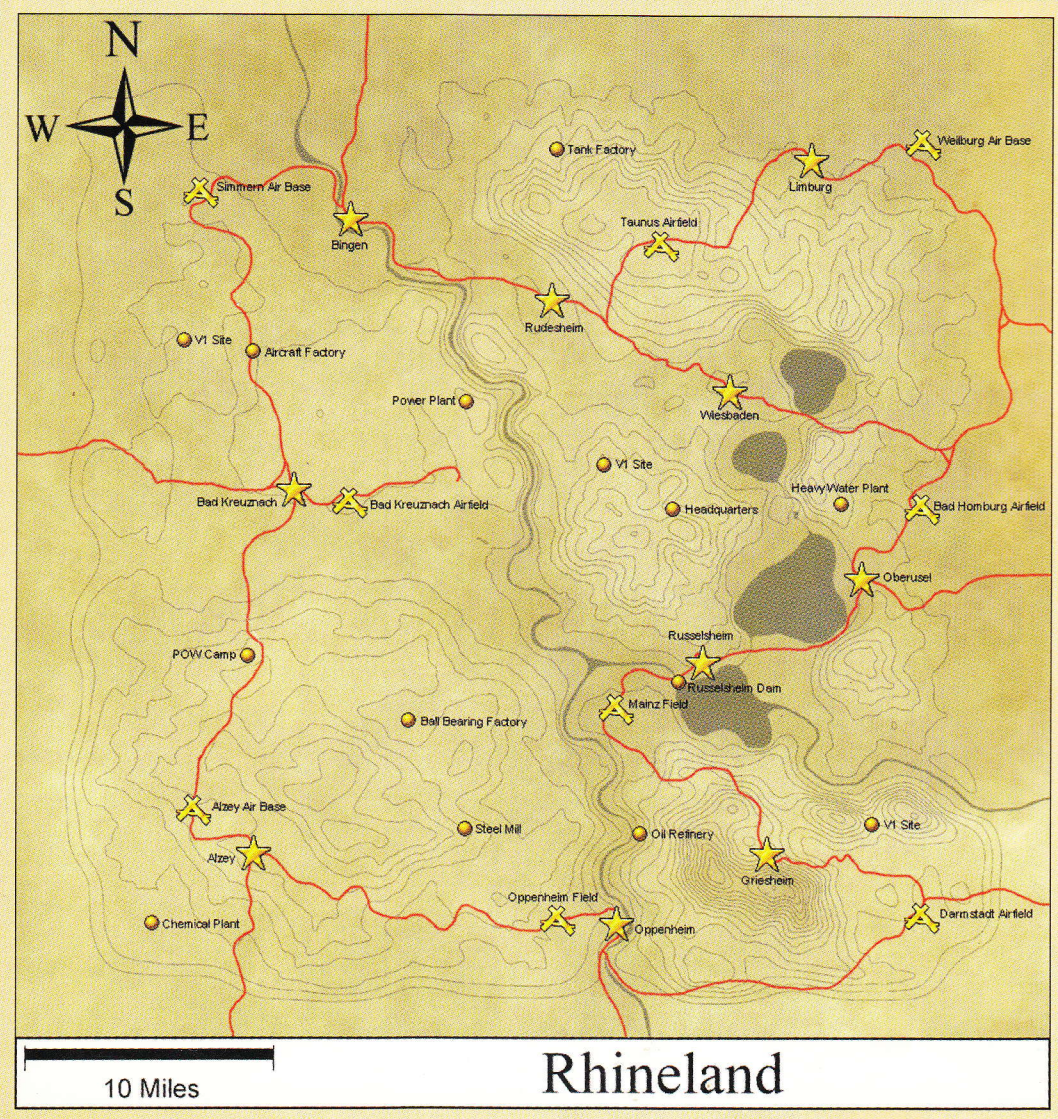

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